Kentucky
Agricultural Experiment Station
State University, Lexington, Kentucky

BULLETIN NO. 182

Hog Cholera and Its Control

BY

ROBERT GRAHAM and E. W. MUMMA

STATE UNIVERSITY PRESS
LEXINGTON, KY.
August, 1914

KENTUCKY AGRICULTURAL EXPERIMENT STATION

BOARD OF CONTROL

RICHARD C. STOLL, Chairman, Lexington, Ky.
CHARLES B. NICHOLS, Lexington, Ky.
LEWIS L. WALKER, Lancaster, Ky.
HENRY S. BARKER, President of the University.
THE DIRECTOR, Secretary, ex-officio.

JOSEPH H. KASTLE, Director.

STATION COUNCIL

THE DIRECTOR

A. M. PETER
H. E. CURTIS
H. GARMAN
C. W. MATHEWS
R. M. ALLEN
J. D. TURNER
E. S. GOOD
GEORGE ROBERTS
J. J. HOOPER

DEPARTMENTAL ORGANIZATION

ADMINISTRATION

THE DIRECTOR, Head.
H. E. CURTIS, Bursar.
HYWEL DAVIES, Purchasing Agent.
O. L. GINOCHIO, Secretary to Director.
ADDIE LEE DEAN, Librarian.
ANNA WALLIS, Clerk.
CORNELIA C. PAGE, Clerk.

AGRONOMY.

GEORGE ROBERTS, Agronomist, Head.
E. J. KINNEY, Assistant Agronomist.
S. C. JONES, Soil Survey.
A. E. EWAN, Supt. Experiment Fields.
JESSIE F. CASWALL, Clerk.

ANIMAL HUSBANDRY

(Beef Cattle, Sheep and Swine)
E. S. GOOD, Head.
ROBERT GRAHAM, Veterinary Science, *In Charge Hog Cholera Serum Production.*
E. W. MUMMA, Asst. In Charge Hog Cholera Serum Production.
O. S. CRISLER, Hog Cholera Serum.
R. L. PONTIUS, Hog Cholera Serum.
W. V. SMITH, Asst. in Animal Husbandry.
M. G. GINOCHIO, Clerk.
C. B. WILSON, Hog Cholera Serum.
LAWRENCE GINOCHIO, Clerk.
E. J. GOTT, Hog Cholera Serum.

ANIMAL HUSBANDRY

(Dairy Cattle, Horses and Poultry)
J. J. HOOPER, Head.
W. S. ANDERSON, Asst. Horse Husb'd.
J. W. NUTTER, Supt. Dairy Farm.
W. D. NICHOLLS, Asst. Dairying.
D. D. SLADE, Supt. Poultry Farm.
P. E. BACON, Elmendorf Milk Records.
F. WALLACE UTTERBACK, Clerk.

CHEMISTRY

A. M. PETER, Chief Chemist, Head.
S. D. AVERITT, Chemist.
J. S. McHARGUE, Asst. Chemist.
R. PFANSTIEL, Asst. Chemist.
ETHEL V. T. CASWALL, Clerk.

ENTOMOLOGY AND BOTANY

H. GARMAN, Entomologist *and Botanist,* Head.
MARY L. DIDLAKE, Laboratory Asst.
E. C. VAUGHN, Asst. in Seed Inspection and Plant Breeding.
H. H. JEWETT, Research Asst. Entom.
H. R. NISWONGER, Asst. in Field Work *and Nursery Inspection.*
LOUISE BEWLAY, Clerk.

FEED

J. D. TURNER, Head.
H. D. SPEARS, Chemist.
E. H. NOLLAU, Asst. Chemist.
ELMER INGRAM, Chief Inspector.
ROGER W. JONES, Inspector.
FANNY C. ROGERS, Clerk.

FERTILIZER

H. E. CURTIS, Chemist, Head.
B. D. WILSON, Assistant Chemist.
WM. RODES, Assistant Chemist.
ELMER INGRAM, Inspector.
R. W. JONES, Inspector.
ANNA WALLIS, Clerk.

FOOD AND DRUGS

R. M. ALLEN, Head.
J. O. LaBACH, Chief Chemist.
L. A. BROWN, Chemist, Drugs.
J. W. McFARLIN, Chief Food Inspector.
W. R. PINNELL, Bacteriologist.
C. S. PORTER, Inspector, Drugs.
WALTER SCHEPPELMAN, Inspector, Bakery Sanitation.
E. F. WORTHINGTON, Inspector, Dairy Sanitation.
W. G. TERRELL, Inspector, Foods.
LILLIE LISTON, Chief Clerk.
LENA LISTON, Clerk.

HORTICULTURE

CLARENCE W. MATHEWS, Head.
F. W. HOFMANN, Asst. in Horticulture.
G. B. WURTZ, Consulting Meteorologist.
MURIEL CASWALL, Clerk.

RESEARCH

THE DIRECTOR, Head.
H. GARMAN, Entomologist and Botanist.
D. J. HEALY, Bacteriologist.
E. S. GOOD, Animal Husbandry.
O. M. SHEDD, Chemist.
MARY L. DIDLAKE, Asst. Entomologist and Botanist.
G. D. BUCKNER, Chemist.
H. H. JEWETT, Research Asst. in Entom.

Notice

The Bulletins of the Station will be mailed free to any citizen of Kentucky who *sends his name and address to the Director.*

BULLETIN No. 182.

REVIEW OF THE HOG CHOLERA SERUM WORK AT THE KENTUCKY AGRICULTURAL EXPERIMENT STATION SINCE 1910.

In 1910 the General Assembly of Kentucky passed an act providing for the establishment at the Kentucky Agricultural Experiment Station of a plant for the production of serum and virus for the prevention of hog cholera, and appropriated the sum of two thousand dollars for this purpose. The small laboratory and equipment provided out of these funds proved entirely inadequate for the production of sufficient serum wherewith to combat this disease. Recognizing the further needs of the farmers of the State in this direction, the General Assembly of Kentucky, at its session in 1912, passed an act providing an annual appropriation of fifty thousand dollars to the Kentucky Agricultural Experiment Station, to be employed in part for enlarging the hog cholera serum laboratory, and for the production of hog cholera serum and virus in larger quantities, "said serum and virus to be furnished the farmers of the State at partial cost of production, and not to exceed one cent per cubic centimeter, and to be distributed through such channels as the Director of said Experiment Station may deem advisable for the protection of the swine interests of the State." The new serum laboratory, hyperimmune sheds and infection sheds, erected out of funds provided for in this second act, were completed in June, 1913. As may be seen from Plate No. 1 of this bulletin, the new serum laboratory is a two-story brick building. The first floor contains a general preparation room, in which the hogs are washed and weighed

(Plate 2); a large, commodious operating room, where the blood is drawn from the hyperimmunes (Plate 3); a room for the washing and sterilization of all instruments and utensils (Plate 4); and a room for the final preparation and bottling of the serum. The second story contains two offices for the veterinarians in charge, and a well-equipped pathological and bacteriological laboratory for the study and investigation of the diseases of farm animals. The basement contains two cold storage rooms in which the serum is stored; a room in which to mix the serum; a boxing and shipping room, and a room for the heating plant. The first floor and basement are made of reinforced concrete, and no pains have been spared to make this one of the most up-to-date hog cholera serum laboratories in the country. The hyperimmune sheds have a capacity of from three to five hundred hogs, depending on the size of the animals. (Plate 5).

The old serum laboratory has recently been enlarged and remodeled and converted into a separate virus house.

The following tabular statement will serve to give some idea of the growth and development of the work of hog cholera eradication at the Experiment Station since the inauguration of this work in 1910:

Serum Produced.

1911	287,814	cubic centimeters	
1912	1,036,435	" "	
1913	4,427,120	" "	
1914	1,322,221	" "	(To June 1st)
Total	7,073,590	cubic centimeters	

Number of Hogs Inoculated.

	Herds	Hogs	
1911	140	5,730	
1912	414	17,591	
1913	923	47,673	
1914	830	31,063	(To June 1st)
Total	2,307	102,057	

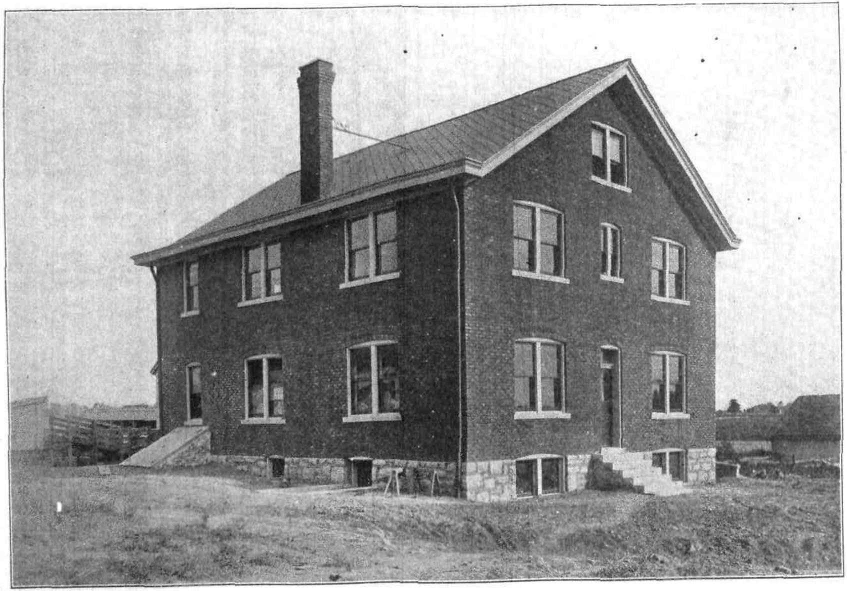

Plate 1. New Serum Laboratory.

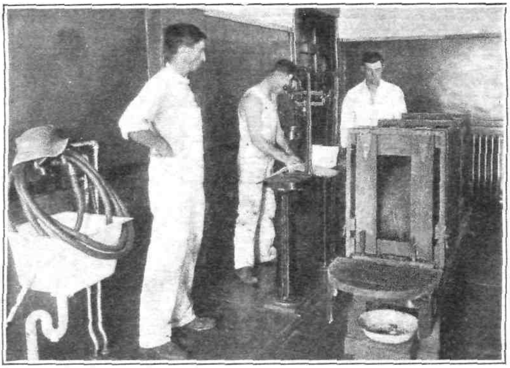

PLATE 2. Weighing and receiving room where each hyperimmune hog is weighed before being bled.

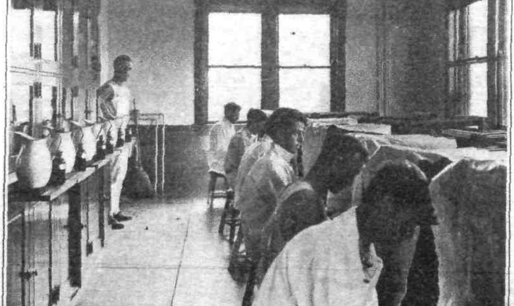

PLATE 3. Drawing immune serum from the tail

Results.

	Lived	Died	
1911	88.2 per cent.	11.8 per cent.	
1912	91.2 per cent	8.8 per cent.	
1913	90.2 per cent.	9.8 per cent.	
1914	91.8 per cent.	8.2 per cent.	(To June 1st)
Average	90.35 per cent.	9.65 per cent.	

Number of counties in which hog cholera serum has been used, 78.

It will be seen from the above that since the beginning of this work, upwards of seven million cubic centimeters of hog

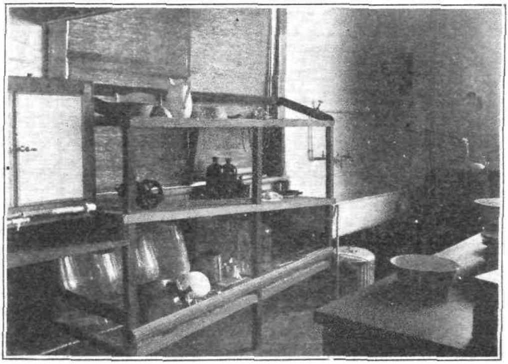

PLATE 4 Sterilizing room.

cholera serum have been produced at the serum laboratory, and that over one hundred thousand hogs have been treated with serum, with a saving of over 90 per cent. of the individual animals thus treated.

During the summer of 1912, the late Director of the Experiment Station, Dr. M. A. Scovell, placed four trained men in the field in different parts of the State, at the Station's expense, to inoculate hogs and to train veterinarians and

other competent persons in the proper administration of the serum and in the diagnosis of hog cholera. The result is that there are now located in various parts of the State, a considerable number of veterinarians and other competent persons who have been trained in the diagnosis of hog cholera and the administration of hog cholera serum. During the past year, practical demonstrations in the inoculation of hogs have been given by the veterinarians at the hog cholera serum laboratory. In this way a number of veterinarians and farmers have been trained in the use and proper administration of the serum, and in the recognition of the more important clinical signs and symptoms of hog cholera. It is proposed also to give occasional lectures and practical demonstrations on the care of hogs, disinfection after hog cholera, the disposal of hog cholera carcasses, etc., etc.

The object of this bulletin is to put in the hands of Kentucky farmers and hog raisers a reasonably clear and comprehensive account of this disease, in all of its phases. The eradication of hog cholera in this State, if it is ever to be accomplished, will require the earnest and intelligent co-operation of all concerned, and the observance by farmers and hog raisers of a few simple, prophylactic precautions, such as the maintenance of cleanly, sanitary conditions in the hog lot and hog house, vigorous disinfection following an outbreak of cholera and the proper isolation of sick and suspected animals. The burning of carcasses of hogs that have died of hog cholera, will materially aid the Experiment Station in the control and eradication of this highly contagious disease, and at the same time, it will materially benefit all engaged in the raising of hogs.

Except in so far as it contains statistics showing the growth and development of this work since it was first inaugurated by the Experiment Station, in 1910, this bulletin contains nothing new or original. As already indicated, it has for its object to give a general yet comprehensive account of this disease. Particular attention is called to the recommendations of the United States Department of Agriculture, relative to the maintenance, upon the farm, of

cleanly conditions, disinfection, the proper disposition of carcasses of dead hogs, etc., etc., as outlined in the proposed hog cholera clubs. With a little effort any man of average intelligence can put into practical operation the simple rules of hygiene therein laid down, respecting the prevention and control of this disease, and their careful observance will go a long way towards the eradication and control of the disease not only upon the single farm, but throughout the community and the State at large.

Those familiar with medical progress during the last half century know that ignorance, superstition, uncleanliness and disease go hand in hand, whereas a general understanding of the nature of disease, cleanliness and the observance of the laws of hygiene have gone far to promote healthful conditions generally, and to prevent and eradicate various infectious diseases. In many of our great cities to-day, vigorous educational campaigns are being conducted against such diseases as typhoid fever and tuberculosis, with the most beneficent results. We need, therefore, to inaugurate here in Kentucky, a campaign of education among farmers and hog raisers against hog cholera. It is with this object that this bulletin on the cause and nature of hog cholera has been prepared by Drs. Graham and Mumma.

JOSEPH H. KASTLE, Director,
Kentucky Agricultural Experiment Station.

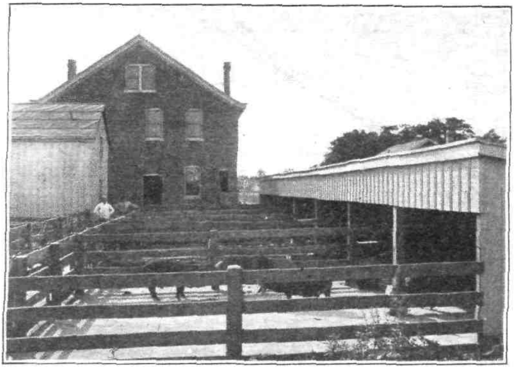

PLATE 5. One side of the hyperimmune shed at the rear of the serum laboratory.

HOG CHOLERA AND ITS CONTROL.

BY ROBERT GRAHAM AND E. W. MUMMA.

Hog cholera is not a new disease. It has existed for many years over large areas of the United States. The first outbreak was reported in Ohio in 1833 by the United States Bureau of Animal Industry. The disease was probably imported into Ohio with an European shipment of hogs, spreading thence throughout the states along the lines of commerce. Hog cholera has caused enormous losses to hog raisers. Dr. C. H. Stange, Director of the State Biological Laboratory of the Iowa State College, estimates the loss in Iowa in 1912 at thirteen million dollars. Dr. R. A. Craig, of Purdue University, LaFayette, Indiana, estimates the yearly losses in that State at approximately three million dollars. Kentucky loses annually approximately two million dollars as a direct result of this disease. The actual death loss, however, should not only be included in this figure, but also the loss from early shipment and marketing of the animals before they are mature in order to avoid the disease. Again, a great loss is sustained in pure bred herds which cannot be reckoned at the average market price of pork per pound. Thus, in 1912 the loss in Madison County, Kentucky, alone was estimated at from forty to fifty thousand dollars. Christian and Henderson Counties sustained even a heavier loss in the year 1913.

Hog cholera and swine plague are terms used interchangeably. These two diseases as well as pneumonia, often occur at the same time in the same herd, alone or simultaneously in the same animal. When swine plague occurs alone, losses are slight. A differential diagnosis is not practicable in the majority of cases. The diseases, however, are roughly dif-

ferentiated by naming one swine plague when the lesions predominate in the lungs, and hog cholera when intestinal lesions predominate. With reference to the two diseases, Dr. W. B. Niles, of the Government Experiment Station at Ames, Iowa, says:

> "My opinion is that while there is possibly a disease which we might term swine plague, it does not occur, at least alone, to such an extent as to cause serious loss in a herd. In fact, I do not believe that it needs to be taken into account. If it should occur in such an acute form as to cause loss I do not believe the serum we make would prevent it. My contention is that while there is a swine plague organism, it does not cause much trouble unless associated with hog cholera, and even then the *hog cholera virus is so nearly responsible for the loss* that the serum will prevent it."

The United States Department of Agriculture in a circular released February 6th, 1914, says in this regard:

> "Remember that hog cholera kills millions of hogs where other diseases kill thousands. Dismiss from your mind all thought of such diseases as 'lung plague,' 'infectious pneumonia,' 'pig typhoid,' etc., for these are generally merely fanciful designations given to hog cholera by uninformed men."

The discovery of the role played by the filtered virus of hog cholera in the development of the disease, caused considerable confusion in the classification of the infectious diseases of swine, in consequence of which a special committee on the nomenclature of swine diseases and their etiology was appointed by the United States Live Stock Sanitary Association. This committee, composed of Drs. Moore, Dorset and Mohler, submitted the following report in 1911:

> "1. Hog Cholera. The name hog cholera shall be given to the infectious communicable disease of swine occurring in epizootics, caused by a filterable virus. This disease is characterized by fever, loss of appetite, rapid emaciation, ulceration of the intestinal mucosa, usually diarhoea and ecchymoses or petechial hemorrhages in various organs and tissues, especially the kidneys and the skin on the ventral surface of the body.
>
> "2. Salmonellosis. The name salmonellosis shall be

given to the infectious disease of hogs (formerly described as hog cholera), possessing a low degree of contagiousness, caused by the Bacillus suispestifer (formerly Bacillus cholera suis), and scarcely distinguishable from hog cholera by the symptoms and post mortem lesions.

"3. Swine Plague. The name swine plague shall be given to the infectious disease of hogs occurring sporadically and enzootically, due to the Bacillus suisepticus. The disease is frequently associated with hog cholera, and produces somewhat similar lesions, but with a greater tendency to pneumonia and pleuritis.

"The name and etiological factors shall be as follows:

"For Hog cholera. A filterable virus until further information concerning it is recorded.

"For Salmonellosis. Bacillus suispestifer, Kruse (formerly known as Bacillus cholera suis).

"For Swine Plague. Bacterium suisepticus, Kruse (fomerly known as the bacillus of swine plague.)"

Hog cholera is characterized by its contagiousness and high death rate. It attacks swine in two forms, acute and chronic. The former is characterized by a sudden onset and rapid course in development, which terminates in the death of the animal. In the chronic form of the disease, the animal lingers for weeks and even months, with ultimately the same result. Although some hogs apparently recover from cholera, the setback from a severe attack of the disease usually makes them unprofitable animals for the herd. However, mild attacks with complete recovery produce an immunity to subsequent attacks of cholera. The so-called outbreaks of hog cholera with a loss of one or two animals in the herd are questionable, for if a correct diagnosis were made, some digestive disturbance or parasitic infection would invariably be found to be the cause of the trouble. The acute and chronic types of cholera are manifestly different, though the causative factor is the same in both cases. The type of the disease is determined by the virulency of the infection and the resisting powers of the hog. It is a well known fact, demonstrated in nearly every outbreak of hog cholera, that certain hogs of the same herd are more susceptible than others.

The lesions of the acute type may not be so well defined as those of the sub-acute or chronic type of the disease. Indeed, a carcass from the very acute type may not show sufficient lesions to permit the infection to be diagnosed as hog cholera. The lesions in the peracute type resemble very closely those of hemorrhagic septicemia. In the chronic type of the disease the intestinal lesions predominate, with circumscribed ulcers in any portion of the alimentary canal especially at the ileocaecal valve.* The latter is the most certain lesion of hog cholera and when found is sufficient evidence to determine the diagnosis of this disease. In general outbreaks the most acute type prevails at first, and is followed by the less acute or even the chronic form. The infection in being passed from one animal to another may gradually become weaker although in some herds every animal succumbs; in others a few may survive. The different types of the disease are often confusing to swine owners, and it should be borne in mind that hog cholera can be present with varied external symptoms.

The Cause.

In 1885, Salmon and Smith† of the Bureau of Animal Industry of the United States Department of Agriculture isolated a small motile bacillus from the tissues of cholera hogs. They designated this micro-organism the Bacillus cholera suis, because they considered it the primary cause of hog cholera. Their findings were confirmed by bacteriologists in this country and abroad, so that the etiolgy of hog cholera was thought to have been definitely established.

Working upon this assumption scientists have devoted their time for approximately twenty years to the discovery of a vaccine or serum to be used as a preventive, the Bacillus suispestifer (formerly called Bacillus cholera suis) being used as a working basis in these investigations. The vaccines and serums thus prepared, however, did not ·ve satisfactory results as applied under ordinary farm nditions. It may be said that during the period of

*union of large and small intestine.

† of the United States Department of Agriculture 1889.

twenty years following the discovery of the Bacillus suispestifer, little or no progress was made in combating the disease. During the course of experiments with the Bacillus suispestifer carried on by the Bureau of Animal Industry of the United States Department of Agriculture, it was noticed that hogs susceptible to real hog cholera did not contract the disease by association with hogs sick from inoculations with the Bacillus suispestifer. This opened a new field of research in the etiology of this disease and experiments were carried on demonstrating the following.

First. That the blood of cholera hogs, when injected into susceptible hogs, produces death with greater regularity than the Bacillus suispestifer.

Second. That after the hog cholera blood is passed through the Chamberland and Berkefeld filters to remove all micro-organisms, so far as the microscopical and cultural demonstrations are concerned, it still possesses the power to produce the disease.

Third. That the only reasonable explanation reached was that hog cholera is caused by an organism of such minute size and structure that it passed through the porcelain filter. Such organisms are referred to as filterable, infinitesimal, invisible and ultra-microscopic viruses. The following table by James Law* shows the relation of the cholera bacillus and the filterable virus in hog cholera, which is very interesting.

"The infinitesmal filterable hog cholera microbe.	Bacillus suispestifer.
1. Very contagious from pig to pig by simple exposure.	1. Not contagious by exposure.
2. Filtered injections subcutem constantly virulent, usually fatal.	2. Pure cultures injected subcutem, usually harmless to pig; deadly to rabbit and guinea pig.
3. Injections of blood subcutem, constantly virulent and fatal.	3. Injections of blood subcutem, usually harmless.
4. Intravenous injections of blood constantly virulent and fatal.	4. Blood intravenously virulent and fatal.
5. Cases that recover strongly immune.	5. Recovered cases show little immunity."

*Veterinary Medicine. Law, Vol. IV. p. 46.

The above table tends to prove that the filterable virus is the primary cause of hog cholera with the Bacillus suispestifer playing the part of a secondary invader, though it must not be overlooked as a factor in the etiology of hog cholera for the reason that the organism discovered by Salmon and Smith accounts for some of the lesions which characterize this disease. Uhlenhuth* found the hog cholera bacillus to be present in the intestine of healthy hogs in 51 out of 600 cases examined. Hutyra† considers the virus responsible not only for the so-called hog cholera, but for swine plague as well. In presenting these various opinions it is well to remember that the cause of the disease remains no longer a matter of contention. The ultra-microscopic organism or virus is believed to be the primary cause, and the Bacillus suispestifer is considered an important but secondary invader. The actual identification of the filterable virus has not as yet been accomplished.

Symptoms of Hog Cholera.

Probably the first symptom noticed by the owner of a herd in which hog cholera exists is a loss of appetite, appearing at first in only one or two hogs, but spreading rapidly each day to healthy hogs. The disease may be well along in the period of incubation, in apparently healthy looking swine. In the acute form of the disease, the animals may die with the external appearance of very few of the symptoms. However, when affected with the sub-acute form of the disease, the hogs may linger several days before death. In the chronic form of the disease, which covers the longest period of any type of hog cholera before death (two weeks to as many months) the appetite may be normal for a few days, which increases the owner's confidence in their condition, to be followed by the absolute refusal of food and water, and later by death. Vomition is frequently observed. Owing to the fever present the infected hogs consume water more readily and regularly than feed. The eating of dirt

*Arbeiten. a. d. Karserlicher Gesundheitsamt. Bd XXVII (1908) p. 425.
†Pathology and Therapeutics of the Diseases of Domestic Animals, Vol. 1.

and other foreign material is quite commonly observed. Some hogs will recover from the chronic type of the disease but they are frequently stunted in growth so that they prove unprofitable to keep, for the reason that they cannot be fattened and may remain a constant source of danger to newly purchased animals by harboring the infection and gradually discharging the same in their excreta.

The skin secretions are abnormal, showing a red, rusty tinge, which become thickened and collect on the outside of the thighs, abdomen, ears or coronets. The skin itself often shows reddish spots or areas of congestion over the snout, ears, or about the coronet and abdomen, which vary in size from a pin point to large blotches which become diffuse and darker as death approaches. These blotches may assume a purplish color at death. The skin lesions are more noticeable in the Chester White and Yorkshire breeds. Along with loss of appetite the animals become emaciated very rapidly. Weakness and loss of strength are very apparent. Affected hogs generally seclude themselves in straw ricks, and in other out of the way places. Diseased animals when forced to move, walk slowly with an unsteady gait. This is especially noticeable in the hind legs, which wobble and weave as the body weight is alternately shifted. In standing the hind quarters are unsteady and sometimes refuse to support the weight of the animal. The abdomen is tucked up so that a very gaunt appearance is presented. Sometimes the animals are constipated and at other times diarrhea exists. These two conditions often alternate in the course of the disease and either is symptomatic. The diarrheal discharge varies in color and consistency, and is frequently influenced by the feed. It may be more or less tinged with blood. In constipation the feces are sometimes covered with mucous, while the urine is highly colored and sometimes tinged with blood. Inflammation of the sheath in barrows and boars with an amassing of urine and dilation of the terminal pouch is quite characteristic.

The respiration and pulse beat are quickened and abnormal in character. Thumps sometimes occur. When the mucous

membrane and lining of the throat and interior passages are inflamed and thickened, the respirations are noisy and difficult. At times a thick, tenacious discharge, streaked with blood, exudes from the nostrils and there is a deep, short hacking cough. The writers have observed a continuous hemorrhage from the nasal passages of very fat hogs suffering from cholera, which lasted frôm two to three days. When the lungs are inflamed (pneumonia), the respirations are quickened and labored, and when the pleural membranes are involved, the respiratory effects are more severe and accompanied by a quickened and increased breathing. Severe pain is produced when the hand is pressed on the chest walls.

The eyes are frequently affected. At first they show an increased lachrymal secretion of normal consistency which collects and thickens on the lashes so that the lids are finally glued together, making the animal partially or completely blind. One or both eyes may be affected. The central nervous system may also be involved. The manifest symptoms are those of inflammation of the brain and spinal cord. The animal may suffer from frequent convulsions during which it may die, or it may pass into a sleepy, comatose condition, also ending in death.

In most cases the body temperature of animals in a cholera herd permits the detection of the absolutely sound animals which are worthy subjects for the serum treatment and the elimination of the affected ones, for which the treatment would probably be too late. The body temperatures of recently affected animals showing no noticeable symptoms of the disease, as well as of those in the advanced stages, are often found to be from two to five degrees above normal.* The higher the fever the more marked the depression of the animal, but in animals approaching death the temperature returns to normal or may even fall to sub-normal. Temperature therefore, is of little value in animals showing symptoms of the chronic form of the disease.

* In full grown hogs the normal temperature varies from 101 to 103 degrees Fahrenheit, and in pigs weighing 100 pounds and under, the body temperature usually is 101 to 103½ degrees Fahrenheit.

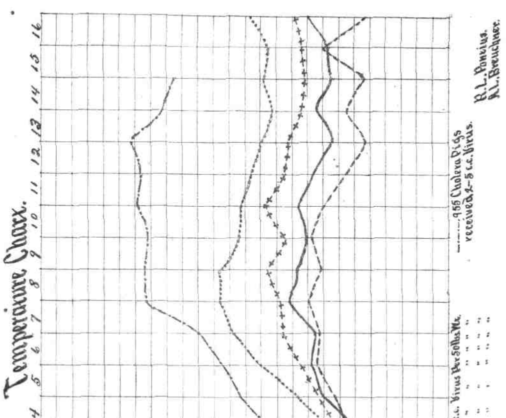
Temperature Chart.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
106.0
105.8
105.6
105.4
105.2
105.0
104.8
104.6
104.4
104.2
104.0
103.8
103.6
103.4
103.2
103.0
102.8
102.4
102.2
102.0
101.8
101.6
101.4
101.2
101.0
60 Pigs received 10 c.c. Serum – 2 c.c. Virus Per Sollus Mx.
62
62 20
62 25
955 Cholera Pigs received 2–5 c.c. Virus.
R.L. Pontius.
A.L. Breuchner.

PLATE 6.

It should be borne in mind that all symptoms do not appear in every outbreak of hog cholera. Some outbreaks show one set of symptoms and other outbreaks show another. If all the described symptoms do not happen to appear one is not justified in saying the disease is not hog cholera, for all outbreaks of hog cholera are not always typical. One owner may lose hogs from cholera as may his neighbor, yet the two herds may present entirely different symptoms. In order to diagnose the disease conclusively, a post-mortem on several sick animals must be held. Such autopsies should be made immediately after killing a sick animal, and never on an animal that has been dead for several hours.

Body Temperature of Swine.

The question frequently arises as to the normal temperature of a hog. The temperature of swine varies greatly, and is influenced by surrounding conditions. Among the most important factors which influence the temperature of an individual hog are atmospheric temperature, driving, handling, hauling, confining, etc.

On twelve hundred healthy pigs, weighing a hundred pounds and under, the average temperature was 102.1 degrees Fahrenheit. (Plate 6). These temperatures were taken between the hours of seven and nine o'clock in the morning, and at an interval of twenty-four to forty-eight hours after being received at the Biological Laboratory. These shoats were used for the production of virus and for testing the potency of serum.

From the temperature chart it is observed that on the twelfth day the maximum temperature of nine hundred and fifty-five cholera inoculated pigs was 105.5 degrees Fahrenheit. The average life of a susceptible pig after inoculation was eleven days.

Sixty shoats receiving 10 cubic centimeters of serum per fifty pounds against 2 cubic centimeters of virus, reached a maximum average temperature on the eighth day following the inoculation, of 103.9 degrees Fahrenheit. Nineteen of these pigs died of chronic cholera.

Sixty-two pigs received 15 cubic centimeters of serum per fifty pounds against 2 cubic centimeters of virus, and on the eighth day following the inoculation showed a maximum average temperature of 103.3 degrees Fahrenheit. Six of these sixty-two pigs died of cholera.

Sixty-two pigs were given 20 cubic centimeters of serum per fifty pounds against 2 cubic centimeters of virus and on the eighth day after inoculation showed a maximum average temperature of 103 degrees Fahrenheit. All of these pigs survived the inoculation.

Sixty-two pigs received 25 cubic centimeters of serum per fifty pounds against 2 cubic centimeters of virus and reached a maximum temperature on the eighth day following inoculation of 102.8 degrees Fahrenheit. One of this number died of cholera.

From this observation it is indicated that simultaneous inoculation may influence the temperature by a mild temperature reaction when complete and full doses of serum are given. This no doubt occurs under field or farm conditions. The herds which appear dull after inoculation no doubt undergo a marked rise in body temperature.

In view of the temperature observations it seems that swine registering over 103.5 degrees Fahrenheit should not receive the simultaneous treatment. In older animals the body temperature is slightly lower and when the temperature registers over 103 degrees Fahrenheit they should not receive the simultaneous treatment. A great many times there is some doubt as to the cause of the elevation of temperature, and virus is administered to animals showing a higher temperature than indicated with perfect results while at other times the reverse is true. In order to remedy this element of danger it is well to administer serum alone to young and growing hogs that register a temperature of over 103.5 degrees Fahrenheit and to older swine showing a temperature of over 103 degrees Fahrenheit regardless of the cause. They can then be isolated or marked and given the simultaneous treatment a week or ten days later.

Predisposing and Accessory Causes With Method to Be Observed in Warding Off the Disease.

Anything which lowers the vitality of an animal renders it more susceptible to disease upon exposure to a virus or pathogenic micro-organism. For example, a one-sided ration of corn fed to hogs may greatly reduce their resistance to hog cholera. Stagnant ponds in poorly drained hog lots; insanitary, ill-ventilated houses; cold, damp sleeping quarters or no sleeping quarters at all; filthy troughs, buckets and slop barrels, are conditions which tend to lower the vitality of the pig and make it more susceptible to disease. These things in themselves do not cause cholera, but they render an animal less resistant, and therefore an easy victim on exposure to this malady. Healthy hogs possess but a slight degree of resistance against hog cholera, hence it is necessary to keep the hogs in the best possible growing condition, in order that they may maintain the maximum amount of resistance against the invasion of the virus. The *so-called remedies and cures for hog cholera, so plentiful upon the market, cannot be considered worthy of mention as cures, or even preventives in the true sense of the word.* Some of these preparations, however, are efficient tonics which, under average conditions, are beneficial in improving the general tone of the system. The practice of so many hog raisers of keeping slack, wood ashes, salt, sulphur, lime and charcoal in the hog lot is to be commended. A good tonic and laxative for hogs, given in Farmer's Bulletin No. 24, by Dr. Salmon, ex-Chief of the Bureau of Animal Industry, is as follows:

Wood charcoal	1 pound
Sulphur	1 pound
Sodium chloride	2 pounds
Sodium bicarbonate	2 pounds
Sodium hyposulphite	2 pounds
Sodium sulphate	1 pound
Antimony sulphide	1 pound

These ingredients are mixed together in the proper amounts and given in the slop or dry feed. A tablespoonful

of the mixture is sufficient for a 200-pound hog. This should not be given more often than once a day, and every other day is generally sufficient except when animals are under treatment. This prescription cannot be relied upon to prevent hog cholera, and is of value only in so far as it improves the general health of the animal.

By reason of the fact that hog cholera is the most widely spread disease among hogs and it tolls the greatest loss to the swine industry, and for the reason further that it is a disease in which sanitation and hygiene play an important part, more attention should be given to its prevention through proper feeding, housing and improvement of the general sanitary conditions connected with the raising of hogs.

Quarantining and Management.

The following precaution should be observed in the quarantining and management of hogs:

1. Newly purchased hogs should be quarantined for thirty days before they are admitted to permanent quarters or allowed to run with the rest of the herd. The purchase of hogs from a healthy herd does not necessarily obviate the danger of cholera as the infection may be picked up in transportation.

2. Dip or spray the quarantine animals at the end of the quarantine period to make doubly sure that they do not harbor infection.

3. It is not advisable even after taking the above precautions, to purchase swine apparently healthy, from recently infected cholera herds, for the reason that even healthy immune animals from infected herds might scatter the infection. This is especially true of the animals coming from herds affected with the chronic form of the disease.

4. Farmers should consider public highways, stock yards and stock cars as infected. Cholera hogs are often penned, stationed or conveyed in the same without subsequent disinfection. Under prevailing conditions, hogs which are appar-

ently healthy at shipment may show symptoms of cholera in eight to thirty days, although healthy prior to shipment.

5. Care should be observed when visiting farms where hogs are dying with cholera and *infected hog pens should not be entered,* as the virus may be carried on the shoes or clothing.

6. All dogs should be kept tied up in order to prevent them from visiting neighboring farms to feed on the carcasses of cholera hogs, thereby bringing the infection home on their feet, or perchance introducing the disease by bringing back a portion of the carcass.

7. Birds (pigeons, sparrows, buzzards and crows) may also carry the infection on their feet from pen to pen and should be kept away if possible.

8. Do not haul to market sick or exposed hogs for a neighbor, as the infection may be carried home on the hog rack, and washed from the rack to the ground by subsequent rains, thereby introducing the infection in your own herd.

9. Running streams draining an infected pasture or hog lot usually carry the infection down the stream and thus scatter the disease. Avoid pastures drained by common streams when cholera hogs are pastured with access to the stream above.

10. Do not throw the carcasses of cholera hogs in the stream or pond, as it simply serves to spread the contagion. All cholera hogs should be burned.

Disinfection.

In order to avoid sweeping outbreaks of hog cholera, hog raisers often dispose of their hogs and in a few weeks or months thereafter purchase other stock only to discover the infection is still present and that the recent additions to their herd contract cholera. It is not known how long the germ causing cholera will live about hog houses, ponds and straw stacks, but it is not safe to buy susceptible hogs for at least a year and there are cases on record of premises harboring the infection for four or five years.

A common question asked by farmers whose premises

have frequently been the site of hog cholera outbreaks is, how long does the virus of hog cholera remain virulent without the use of thorough artificial disinfection? It is next to impossible to accurately answer this query, because of the wide range of conditions covered. In general it might be said that the virus of hog cholera can resist the direct rays of the sun for only a few hours, but where this minute organism is sheltered by boards under troughs and beneath the wooden floors of stables, it would remain virulent for a very long space of time. Cold plays a very small part in the destruction of hog cholera virus and even the severest winter weather encountered in this section would not be sufficient to destroy it alone. Old torn down houses, fences and straw stacks where cholera pigs have slept should be burned. This will often be the cheapest procedure in the long run. Where this is not practicable thorough disinfection should be carried out. This should be executed in the most exacting way. Partial or inefficient disinfection is practically useless. To disinfect where fumigation with formaldehyde cannot be used, the spray pump furnishes the best means. It should be borne in mind that the disinfectant does not destroy the micro-organism with which it does not come in contact. All large accumulations of bedding, manure and cobs should be removed and burned. Every place that may harbor a micro-organism should be reached with the disinfectant. Special care should be given to drive it into every crack, under every loose board, on top of every beam and into every partly concealed hole, as well as upon every exposed surface. Liquor cresolis compositus, 6 ounces for every gallon of water, or 1½ pounds of lime and ½ pound of carbolic acid to each gallon of water, or one of the coal-tar dips of a strength of one part of the dip to 15 parts water, are best for this purpose. A better emulsion can be obtained with these dips by adding a small quantity of alkali to the water. After disinfecting the hog house, fencing, feeding troughs and floors with any of the above mentioned solutions they should be whitewashed with lime water containing one pound of chloride of lime to about three gallons of water. This may be applied with a brush

but better with a spray pump. The hog lot should be cleaned and lime scattered about the ground. A saturated solution of iron sulphate can be sprayed about the hog pasture with excellent results, or a thin layer of straw can be burnt over infected ground.

Advice to the Attendant.

The care and treatment of a cholera herd require work and close attention to details on the part of the persons having this work in hand. The indifferent, careless treatment is invariably rewarded with poor results.

1. *Clean the troughs after each feeding and thoroughly* disinfect them with Liquor cresolis compositus, or with one of the coal-tar dips. It is a good plan if possible to turn the *troughs bottom side up after cleaning until the next meal to* avoid contamination or to allow a mild antiseptic solution to stand in them between meals. The small amount which adheres to the trough after draining is harmless provided any of the coal-tar preparations are used. Exclude whole corn from the feed of exposed or sick hogs. Give a light, laxative diet of a thin slop of shorts with the prescribed dose of the tonic powder previously referred to. The dose administered will vary with conditions.

2. Copper sulphate (powdered bluestone) may be given in the slop. Dr. R. A. Craig, of the Indiana Experiment Station, recommends the use of 8 ounces of finely powdered bluestone dissolved in a gallon of water. One pint of this stock solution to about eight gallons of water or thin slop is given once a day. This should be employed previous to the time the symptoms appear, as a possible preventive and continued for several days after the hogs have apparently recovered.

3. Do not give the hogs any more feed than they will clean up.

4. *The attendant of the healthy herd should not feed or* enter the yards or pens of the sick animals. If this is not possible, in cases where only one man is available, he should

always change his outer clothing and thoroughly disinfect or change his shoes.

5. Do not use slop pails or slop barrels in common for healthy and sick herds.

6. Note the relation of the yards of the healthy herd to those of the sick herd with special reference to drainage. If the drainage is from the infected yard to the healthy pen, it will be only a matter of time until the infection is carried by surface drainage to the healthy lot, and all efforts to control and check the outbreak by disinfection and quarantine will be in vain. In controlling outbreaks of hog cholera every little detail must receive consideration, for if only half done, it is just as well not to observe any of these measures at all.

7. *Burn Carcasses of Cholera Hogs.* The dead body of the hog carries the virus of cholera in abundance and burning or deep burying furnishes the only sure means of getting rid of the infection, Burning is always to be preferred to burying. Do not allow other hogs, dogs, birds or chickens to come in contact with the carcass. Do not transport a carcass to an isolated spot on the farm thinking that this is sufficient elimination to insure the health of the remainder of the herd. If buried, place the carcass under four feet of earth and cover it with lime; it is preferable to destroy it by fire as buried carcasses have been unearthed after several years and have caused outbreaks of cholera. Burning can be accomplished by first firing a small pile of wood, or cornstalks, and laying the animal belly down on the pile, but the destruction of a carcass is facilitated by digging two trenches twelve to eighteen inches wide and five to twelve feet in length that intersect each other at right angles. (Plate 7.) This allows a draft no matter which way the wind. Four iron bars are placed across the top of the trenches at their intersection to support the carcass. Before the hog is placed on the iron bars the carcass should be opened through the thoracic and abdominal cavities with a butcher knife, and a cupful or more of kerosene poured over the abdominal organs. The carcass should then be placed belly down on the bars. The heat is thus

kept in the body of the hog and as soon as the contents of the stomach and intestines have burned the fat will ignite and will of itself nearly destroy the carcass. Do not try to burn a hog by placing it on its back. If a little kerosene is poured on the fuel it will greatly hasten the burning of the carcass. The fire is then started directly below, using at first dry pine boards and later ordinary stove wood is heaped below and on top of the carcass. Soon the carcass is inwrapped in flames and its complete destruction is only a matter of a short time.

PLATE 7. Method of burning hog cholera carcasses.

This is a very simple yet efficient and easy method of burning diseased carcasses and should be practiced in destroying animals that have died of any infectious disease on the farm.

Post-Mortem.

With respect to the appearance of a hog after death from hog cholera, Dr. M. Dorset, Chief of the Biochemic Division of the United States Bureau of Animal Industry, says:*

*Farmers Bulletin No 379.

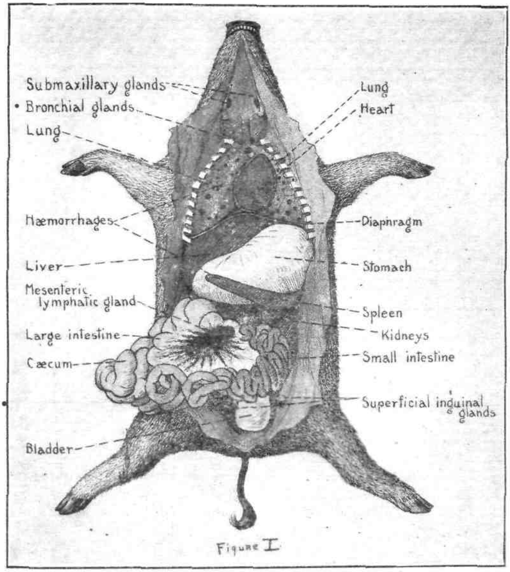

PLATE 8. Showing the relation of the internal organs of the hog.

"In regard to the examination of hog carcasses on the farm, it may be well to state that while hog cholera is not communicable to man, there is always danger of the hog being infected with other diseases, such as tuberculosis and anthrax, which are highly dangerous to man, and for this reason care should be exercised in examining carcasses of sick hogs so as to avoid a cut or scratch on the hands which might serve as a point for the inoculation of disease.

"The post-mortem examination of a hog should begin with the skin, which may show the red or purplish

blotches which have been mentioned above as one of the symptoms of hog cholera. When the examination of the skin has been made, the organs of the body are examined in the following manner: The hog is laid on its back, and, beginning at the throat, an incision is made along the middle of the chest and belly, through the skin and underlying fat, and extending the entire length of the body. The next step is to dissect back the skin of the chest so that the ribs are exposed. Now, beginning at the lower border of the ribs, about one or two inches on either side of the breast bone, and cutting toward the head, the ribs on both sides are severed, the central portion, including the breast bone, being removed entirely. Crosswise incisions, extending from the first long incision toward each leg, are now made in the skin in such a manner that this may be laid back on both sides of the body, thus exposing to view the various organs which lie in the chest and abdominal cavities. (See Plate 8). While the carcass is being opened, care should be taken to avoid injuring the organs. The important organs are examined as follows.

"LUNGS. The healthy lungs are pink in color, soft, and filled with air. Occasionally, in that portion of the lungs nearest the neck, small, solid, dark areas may be seen in healthy hogs. Such areas without other lesions are not to be regarded as indicating hog cholera. In acute cases of hog cholera the surface of the lungs frequently show numbers of small red spots of varying size which are caused by the rupture of minute blood vessels, thus allowing the blood to escape into the tissue. (Plate 9.) These spots can not be washed off with water and when found are an important indication of hog cholera. It is not unusual to find that large portions of the lungs are consolidated, and instead of being soft, filled with air, and pink in color, as is the case in normal lungs, the organs are heavy, solid, and of a grayish or dark-red color. This consolidation of the lungs is not so characteristic of hog cholera as the reddish spots mentioned above.

"HEART. The heart is inclosed in a thin membranous sac which can be easily slit open and removed so as to permit a satisfactory examination of the organ. In cases of hog cholera, the surface of the heart may show bloody-looking blotches similar to those seen in the lungs and which, like those in the lungs, can not be washed off

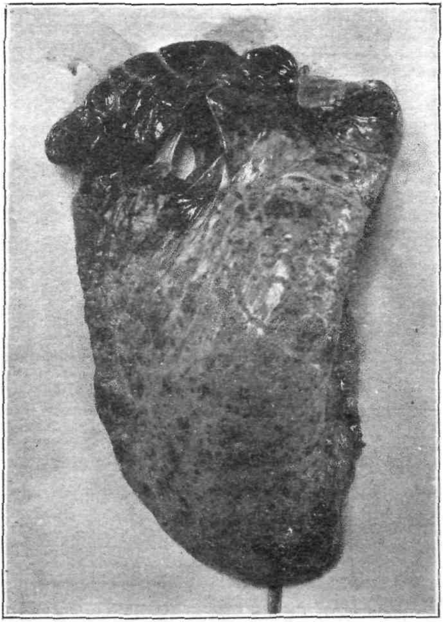

PLATE 9. Lung tissue from cholera hog.

with water. These bloody spots on the heart are rarely seen except in very acute and virulent forms of hog cholera.

"LIVER. In cases of hog cholera the liver generally shows no marked change from the normal condition. It may be at times darker than normal in color, and if cut with a knife blood will exude. This indicates simply that the organ is congested. In some cases the liver may be of a light-grayish color, due to the increase of fibrous substances. Neither of these conditions is especially characteristic of hog cholera.

"SPLEEN. The spleen, or melt, which is found on the right-hand side of the hog's body as viewed at autopsy, lying a little below and to the right of the stomach, is in acute cases of hog cholera found almost without exception to be quite large, dark, and soft. In the prolonged, chronic cases, however, the spleen may be even smaller than normal and rather grayish in color.

"KIDNEYS. The kidneys, which lie beneath the intestines as viewed at autopsy, can be easily removed by pulling aside the soft fat and tissues which surround them and cutting the round tube which holds them to the body. The thin fibrous tissue which surrounds the kidneys should be carefully peeled off without cutting into or injuring the organ, and if the case is one of acute hog cholera, it is very likely that the normal light-brown color of the kidneys will be found to be changed to a much darker color, and there may be seen over the surface a number of very dark-red points, some of these no larger than a pin point, whereas others may be larger than the head of a pin. The appearance of the kidneys frequently reminds one of the speckling of a turkey's egg. These spots are caused by the escape of blood from the small blood vessels in the same way as the larger reddish spots which occur in the lungs and on the heart. Both kidneys should be examined. (Plate 10.)

"STOMACH. The stomach is the large white pouch-like organ which is situated in the upper part of the abdominal cavity next to the lungs and by the side of and partly underneath the liver. Usually the external surface of the stomach shows no change from normal, though occasionally there may be observed small red spots similar to those which have been described as appearing in the lungs, heart, and kidneys. The stomach

should be opened by cutting the front wall from one end to the other. The partly digested food which is usually found within the stomach is removed and water poured in so as to clean the inner surface and permit a satisfactory examination. The normal stomach lining is a uniform, rather wrinkled, pinkish-looking membrane. It is smooth and free from distinct hemorrhages. In cases of hog cholera it is not infrequent to find large portions

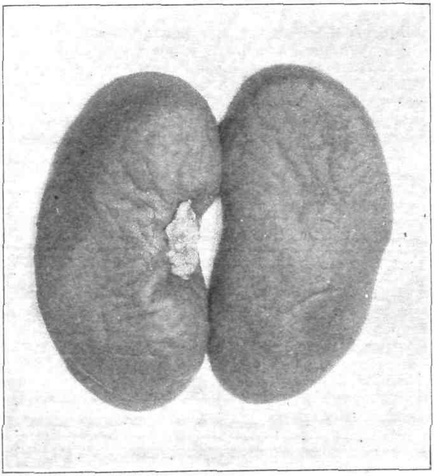

PLATE 10. Kidneys from cholera hog.

of this lining membrane of the stomach very much inflamed and red, and a careful examination will frequently show that this lining membrane has been ulcerated. The ulcerated portion usually extends over a considerable area of the lining membrane of the stomach and is separated from the healthy portion by a more or less distinct line.

"SMALL INTESTINE. The intestines are connected directly to the stomach. The small intestine is that portion which begins at the stomach and continues until a distinct union is made with a portion of the large intestine known as the cecum or blind gut. In normal hogs both the outer and inner surfaces of the small intestine resemble considerably those of the stomach, though of course the walls of the intestine are not nearly so thick. The small intestine is well supplied with small blood vessels which can be distinctly seen. In some acute and virulent types of hog cholera the

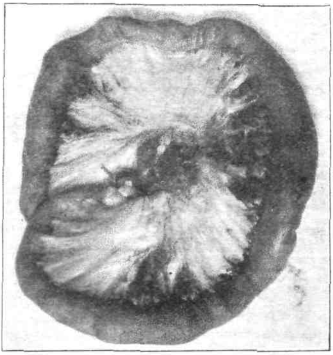

PLATE 11. Hemorrhages in mesentary and on outer surface of small intestines.

outer surface of the small intestine may be literally covered with bloody spots, giving one the impression that blood had been spattered over these organs, but upon washing .them with water it will be found that these bloody areas can not be removed. There is no other characteristic lesion of the outer surface of the small intestine. (Plate 11.) The inner lining, however, may at times, in cases of hog cholera, be congested and inflamed, so that the normal wrinkled inner surface is greatly thickened and covered with a yellowish exudate

or coating, or it may be dotted with small bloody spots like those seen on the outer surface of the intestine.

"LARGE INTESTINE. The large intestine differs markedly from the small intestine in general appearance, being larger in circumference and of more uneven surface. The appearance of the large and small intestines in health and their relative positions in the body are shown in Plate 8. In cases of hog cholera the outer surface of the large intestine may show the same hemorrhagic spots that have been mentioned as occurring on the small intestine, but it is the inner lining that shows the most important changes.

In acute cases of hog cholera the inner lining of the large intestine is frequently found to be blood stained and small areas of a bloody extravasation are seen. It is also frequently found that the feces contained in the large intestine are bloody, due to blood having escaped from the bleeding portion of the intestine. In the case of hogs which do not die quickly from the disease—that is, in chronic cases—we are apt to find on the inner surface of the large intestine what are generally regarded as the most characteristic lesions of hog cholera. These are the so-called 'button' ulcers. These ulcers are usually round, hard, and yellowish, with a dark center, and are distinctly raised above the surrounding healthy inner surface of the large intestine. They vary greatly in size, some being very small points, whereas others are larger than a silver 25-cent piece. Once these lesions have been seen, they can not be mistaken afterwards. A very good idea of their appearance is given in Plate 12.

The finding of the typical button ulcer may be considered as a positive indication of hog cholera, and it is the only lesion that can be regarded as absolutely diagnostic, though the bloody points or hemorrhages in the kidneys, heart, and other organs of hogs are rarely seen in diseases other than hog cholera in the United States.

"LYMPHATIC GLANDS. Aside from the lesions of the various organs which have been described, the changes which take place in the lymphatic glands of a hog that has died from hog cholera are of much importance. These glands are found in different parts of the body. The most important ones to be examined are those in the inguinal region; these will be readily found and recog-

nized by the farmer. These glands are situated in the fat just under the skin of the abdomen, near the median line of the body, and between the hind legs (see plate 8). These glands, if normal, will be found to be of a rather light-grayish color. After normal glands have been seen the changes which occur in cases of hog cholera will be readily recognized. These changes consist chiefly in an

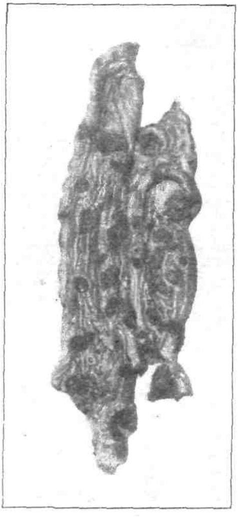

PLATE 12. Intestinal ulcers from case of hog cholera.

enlargement of the glands together with a marked reddening. At times these glands are so red as to appear almost black, and if they are cut through with a knife it will be found that the exterior or rind is the portion chiefly affected. Other lymphatic glands which undergo a change of this kind in hog cholera are found at the

angles of the lower jaw, in the neighborhood of the heart, and beneath the liver and stomach.

"SUMMARY OF POST-MORTEM APPEARANCES. To recapitulate, then the important lesions found after death from hog cholera are as follows:

1. Reddening of the skin.
2. Bloody spots in the lungs, on the surface of the heart, in the kidneys, on the outer surface and inner lining of the intestines and the stomach.
3. Reddening of the lymphatic glands.
4. Enlargement of the spleen.
5. Ulceration of the inner lining of the large intestine.

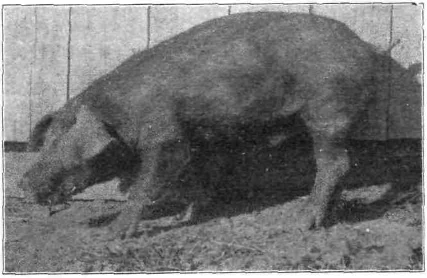

PLATE 13. Hog sick with cholera.

Any one or all of these lesions may be found in a hog which has died from hog cholera. It is rare to find all in any individual case, although at times we do find a perfectly typical picture showing all of the lesions described above. On the contrary, it has also been noticed that hogs suffering with a virulent form of hog cholera may at autopsy show only an enlarged spleen or a hemorrhagic or bloody condition of the lymphatic glands. In the lingering or chronic cases of hog cholera it is usual to find the intestinal button-like ulcers, while the hemorrhagic lesions described above are, as a rule, absent."

Losses From Inoculation.

It is frequently reported that healthy hogs are killed by inoculation. In a great many instances the chronic form of the disease exists in the herd without the owner being aware of it. The loss of one pig every five or six days does not cause alarm, but it is a very suspicious symptom of chronic cholera. A complete and true history of the herd should be given to the veterinarian before treatment, and the owner should be very careful to know that the serum to be used is potent. There are some commercial serums which do not give satisfactory results. In all cases of irregular results examined, complications existed, and not always was the serum lacking in potency. Hog raisers should secure serum from laboratories which have a State or Government license. In case the Experiment Station is unable to supply hog cholera serum, the names of these establishments will be furnished on application.

Irregular results in inoculation may occur when there is heavy infestation of parasites, when lice or worms are present; when tuberculosis or pneumonia exists in the herd; when too small a dose of serum or when too large a dose of virus is administered; when animals are ringed or castrated after inoculation, and when pens and sheds are allowed to become filthy and insanitary. Animals that are not perfectly healthy should not be subjected to the serum-simultaneous method of immunization.

Inherited Immunity.

A dam which has received the serum-alone treatment does not seem to transmit immunity to her pigs. Pigs from dams immunized by the serum-simultaneous method inherit a passive form of immunity. At the age of four to six weeks, however, they are frequently found susceptible to the disease. In some cases it has been shown that up to the age of three weeks, suckling pigs can withstand the subcutaneous inoculation of a quantity of cholera blood that would produce death in a susceptible animal of almost any size. We have given small quantities of virus to pigs from dams that had

been immunized by the serum-simultaneous method with but few fatalities. Inasmuch as we were not certain that these pigs were subsequently exposed to the infection, the length of the immunity produced by virus alone in such pigs is still uncertain.

Securing New Stock.

The first thing to be done after the premises and hog houses have become infected is to thoroughly disinfect them before new stock is purchased. When new stock is purchased, they should be vaccinated by the simultaneous method. There are many breeders who are furnishing immune hogs, and this department will gladly refer parties to these breeders.

Veterinarians Should Inoculate When Possible.

It is far better for swine owners to employ well-trained veterinarians to administer the serum. Great stress is to be laid upon the proper administration, and it is a dangerous procedure for the farmer to handle the virulent blood, as it is a very easy matter to start an outbreak of hog cholera from an overdose of same. Veterinarians who have received proper instructions in the method, and are qualified to handle the infectious materials can reduce this danger to a minimum. Owners should insist that veterinarians employed by them be properly qualified.

Uniform Method of Hog Cholera Eradication.

Hog cholera has caused a great loss to the State of Kentucky in the last few years. In order to combat this disease, a uniform method, in addition to the hearty co-operation of everyone concerned, is essential. There are many different plans to accomplish this great undertaking, most of which are beyond our reach, because of shortage of funds and the inability to establish proper quarantine in infected herds. An act of Congress indicates a far more liberal policy than ever before in assisting farmers to stamp out this disease, and government co-operation in combating hog cholera, is already under way in Henderson County, Kentucky.

The problem of supplying sufficient serum for all exposed herds has been solved by the erection of a laboratory sufficiently equipped for the purpose of preparing this product. It has a capacity of producing 300,000 cubic centimeters of serum per week. This serum is sold at one cent per cubic centimeter to the farmers of this State. The aim of the hog cholera serum laboratory and experts from the Experiment Station is to assist in every possible way in co-operating with the farmers and veterinarians in stamping out this disease.

Resolutions Unanimously Adopted at a Conference of Federal and State Officials in Charge of Hog Cholera Suppression, Auditorium Hotel, Chicago, Illinois, March 3rd, 1914.

Dr. A. D. Melvin, Chief, Bureau of Animal Industry, U. S. Department of Agriculture, Chairman of the Meeting.

The following important resolutions are of interest to all swine breeders. These resolutions were unanimously adopted at a conference of Federal and State officials in charge of hog cholera suppression, and if followed out will assist materially in suppressing hog cholera in Kentucky:

"We regard hog cholera as one of the greatest questions before the public at this time. The disease has been prevalent many years, with losses fluctuating between wide limits. The heaviest losses, as shown by the best available data, were 120 and 130 hogs per thousand in 1887 and 1897, respectively. The estimates for 1913 are 100 loss per thousand, and the indications are that the disease is passing through another period of rapid increase. In view of the high cost of living, such enormous losses of a valued food product must be regarded as a calamity.

"The main problem at this time is to control the disease. With progress now being made, both in science and practice, it may be expected that the question of eradication will come up later; but, unquestionably, the matter of control will be uppermost for years to come.

"For success, the first requirement is an honest and earnest purpose to co-operate as between all the interests involved, especially the scientists, the veterinary profession, farmers, common carriers, and packing interests.

"The control and final eradication of hog cholera will depend largely upon the education of farmers to the importance of observing sanitary principles.

"The serum-alone treatment may be given by anyone without danger of causing hog cholera. Such harm as follows this treatment is due mostly to ignorance in the use of serum or of sanitation. While it is preferable to have serum used only by competent veterinarians, it is not deemed advisable to require that laymen may not use serum alone.

"The closest possible supervision of the manufacture and distribution of serum should be provided to assure its purity and potency. It is believed that this should be in charge of the federal authorities in such plants as may properly come under their supervision, and provisions should be made in the different States to duplicate and supplement the federal efforts along this line.

"It is desirable for the States to manufacture serum, but neither by the size of the plant nor by the price of the product, should this effort be monopolized by the States.

"The simultaneous treatment should be used by those who have had special training. The ideal arrangement would be to allow its use only by federal and state veterinary officers. Other officers who have had sufficient training in the use of virus, and in sanitation, may use the simultaneous treatment with safety. Where it is not possible to restrict virus to official hands because of shortage of funds or lack of officers, or for other uncontrollable reasons, it should be used only by such persons as have been given a special permit after receiving instruction, which is as thorough and detailed as feasible, and who show that they understand the essential fundamental principles. But in any such case, the unofficial layman should be permitted to use virus only in his own herd, and then only if the district is already infected.

"The manufacture, distribution and use of virus should be rigidly supervised by federal and state authorities.

"Quarantine and sanitary measures should be much more actively emphasized and enforced. Especially, is it important that freight cars which have carried infected stock shall be promptly disinfected after unloading, and infected premises should be rigidly quarantined.

"The prevailing practice of rushing sick stock to

market should be discouraged in every way possible, and in lieu of such disposal of sick herds, the owners and other persons concerned should be advised and encouraged to treat them with anti-hog cholera serum.

"The promulgation and enforcement of all live stock sanitary regulations should remain invested in the live-stock sanitary boards and state veterinarians of the various states.

"Progress in combating hog cholera is being made. Special credit is due to individual efforts on the part of veterinarians and farmers. The intelligent interest of county agricultural agents is commended, and it is believed that these agents should give chief attention to assisting farmers to secure the aid of competent veterinarians, and when that is not possible, they should assist the farmers themselves to take proper remedial measures, always emphasizing the importance of sanitation. There is recommended the temporary assignment of a competent veterinarian by the state government, independently or in cooperation with the federal government, to any district where difficulties on account of hog cholera are most acute, his services to be available to farmers without cost, for the purpose of demonstrating the best methods in different communities.

"Work of the highest character is being done in the United States Bureau of Animal Industry, which Bureau brought out the serum treatment for hog cholera, a treatment which has been adopted in most states and countries where the disease exists. We acknowledge with appreciation the action of Congress, whereby far more liberal provision than ever before has been made to investigate and combat the ravages of hog cholera. Similar provision has been made in several states, but the legislatures are urged to make more liberal appropriations of this character.

"There should be the closest co-operation between state and federal authorities, and all persons concerned should be willing to suppress their own opinions on relatively unimportant matters, and follow the lead of federal authorities in the interest of the adoption of uniform methods throughout the entire country.

(Signed): G. R. WHITE, Tennessee.
W. M. JARDINE, Kansas.
W. B. NILES, U. S. Dept. of Agriculture.
WARD GILTNER, Michigan.
R. A. PEARSON, Iowa, Chairman."

Hog Cholera Clubs.

With the object of combating hog cholera, State anti-hog cholera clubs have been formed in certain States under the auspices of the United States Department of Agriculture and the College of Agriculture of the respective States. It is hoped that at no distant date, arrangements can be made for the formation of a number of anti-hog cholera clubs in various counties in Kentucky. The following is the prospectus of the anti-hog cholera clubs of the State of Missouri, setting forth the object and plan of operation of this organization. The plan of operation is such as to commend itself to all interested in the raising of swine.

"Object.

"The object of this organization is to eradicate hog cholera from the farms of the members of this club and from the neighborhood and county; and to encourage proper methods of hog farm management that will insure a permanent freedom from hog cholera, and a minimum of losses from the ordinary swine diseases to the end of establishing and maintaining swine breeding and swine feeding upon a safe and profitable basis on our farms.

"Plan of Operation.

"1. DISINFECTION: The destruction of the germs of the disease is essential to success in eradicating hog cholera. Fire is the most efficient means of destroying hog cholera virus and where it is applicable should be employed. Fresh air-slaked lime stands next in value as a general disinfecting agent for the destruction of hog cholera germs. Next in order is the compound cresol solution made according to the formula of the United States Pharmacopoeia, and used in a 3 per cent water solution—all these agents can be used to good advantage. Lime should be used freely on the floors of hog houses and over the grounds of the breeding pens and feed lots. The litter and dung should be scraped into piles, mixed with fresh air-slaked lime, a little water added, and after standing two or three days, scattered on the fields. Whitewash the inside of hog houses and cots, or spray thoroughly with a 3 per cent solution of compound cresol solution.

"2. QUARANTINE QUARTERS OR ISOLATION HOSPITAL. There should be provided separate pens where sick hogs can be taken at the first signs of sickness and where hogs can be placed for two or three weeks after being purchased before being turned in with the rest of the herd. No hogs under any conditions should be brought on the place without going through this quarantine.

"3. BURN ALL CARCASSES. It is the requirement of the law that all hogs dying from any disease be burned, as shown on page 222 of the Session Acts of the 47th Missouri General Assembly. Failure to observe this statute subjects the offender to arrest and prosecution. Also, burn the carcass of any other animal that may have died from any disease or accident, as carcasses attract dogs and buzzards that may have fed upon cholera hogs.

"4. INFECTION CARRIERS. Special watch should be made of dogs, pigeons, buzzards, crows and persons coming from infected premises, as all are quite liable to bring cholera germs on the place. But if the foregoing are carefully carried out throughout the community there will be little infection to carry, and danger from this source will be practically eliminated.

"5. NOTIFICATION. The law prescribes that when cholera occurs on any farm, the owner shall notify the neighbors. When non-members of this organization persist in maintaining sources of infection, steps should be taken to notify the State Veterinarian, whose duty it is to establish an official quarantine.

"6. PREVENTIVE INOCULATION. The object of this campaign is to eradicate hog cholera at the least possible cost, and to depend more on sanitary measures and good hog farm management than on the use of serum. However, whenever an outbreak of cholera does occur, the Veterinary Department, College of Agriculture, University of Missouri, Columbia, Mo., should be notified at once, and serum will be supplied at cost for vaccinating the affected herds and, if necessary, other herds that may have been exposed.

"7. PURE WATER SUPPLY. Hogs should not be given access to ponds or running streams, particularly if the source of such streams is not on the farm of the person concerned.

"8. EXTERNAL PARASITES. External parasites are a menace to the health of hogs. To rid them and their

quarters of these pests, a spray of crude oil or kerosene emulsion is particularly recommended.

"9. WORMS. When the herd is infested with worms it is well to use Santonin, 6 grains, calomel, 4 grains, per 100 pounds weight of hog. Feed in a thin slop after the hogs have had no feed for a day or two. A good mixture to keep before the hogs to prevent worms is: Sal soda, 3 pounds; Glaubers salts, 3 pounds; Copperas, 3 pounds; common salt, 3 pounds; sulphur, 1 pound; charcoal, 4 pounds. Mix thoroughly and keep in a trough in a convenient place.

"10. BALANCED RATIONS. A balanced ration aids materially in keeping hogs in good health. When feeding in the dry lot, corn can be balanced by feeding corn 6 parts and oil meal 1 part; or corn 3 parts and shipstuff 1 part; or corn 10 parts and tankage 1 part. Leguminous roughness is also excellent.

"11. FORAGE CROPS HARVESTED BY THE HOGS: From the time rye, wheat, clover or alfalfa starts in the spring until the last pasturing goes in the fall, hogs should be kept out in the fields. Rape planted in rows will make pasture throughout the season, and it can scarcely be equaled as a forage for hogs. It cannot be urged too strongly to keep hogs on the plowed fields rather than on permanent pasture. This applies from the standpoint of health, labor and soil fertility. A good three year rotation for hogs is: 1. Corn and cowpeas. 2. Soy beans—for winter feed. 3. Rape.

"12. SHADE, CORN AND WATER: Temporary shade should be provided in such a way that it can be moved from place to place. When throwing out corn, throw it in different places. An old wagon filled with corn hauled out and left in one place until fed out, then refilled and hauled to another, and so on around, makes an excellent plan. Water should be supplied from barrels or tanks, hauled to different places in the fields where the hogs are pasturing.

Instruments for Vaccination.

Glass barrel syringes should be used for this work. A twenty cubic centimeter syringe is preferable for the administration of serum, while a ten cubic centimeter syringe is preferable for administering virus. (See plates 14 and 15.) It is not convenient to draw the serum from the bottle into the syringe, and sterile containers must be used. These containers should be of porcelain or granite-ware, with movable covers, so that they will stand boiling and will not be easily broken or upset. Containers as well as syringes should be thoroughly boiled for about five minutes before using. *The most convenient place to inject the serum is in the inner face of the thigh or in the neck.* Serum and virus should always be injected into opposite sides of the body.

The Dosage for Serum.

10 c. c. up to 10 lbs. in weight.
15 c. c. for all sizes between 10 and 20 lbs.
20 c. c for all sizes between 20 and 50 lbs.
30 c. c. for 75 lbs. or more than 50 lbs.
50 c. c. for 150 lbs. or more than 100 lbs.
60 c. c. for 200 lbs. or more than 150 lbs.
70 c. c. for 250 lbs. or more than 200 lbs.
80 c. c. for 300 lbs. or more than 250 lbs.
90 c. c. for 400 lbs. or more than 300 lbs.
100 c. c. for more than 400 lbs.

The Dosage for Virus.

⅛ c. c. for pigs up to 4 weeks of age.
¼ c. c. for pigs 4 weeks to 50 pounds.
½ c. c. for sizes 50 to 100 pounds.
1 c. c. for sizes over 100 pounds.

According to an act of the General Assembly, approved by the Governor, March 11, 1912, anti-hog cholera serum and virus are to be furnished to the farmers of the State at partial cost of production, and not to exceed one cent per cubic centimeter and to be distributed through such channels as the

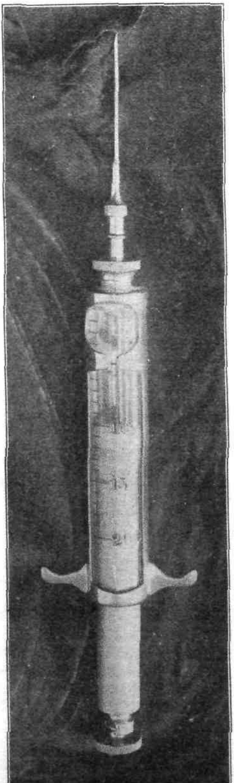

PLATE 14. Serum syringe.

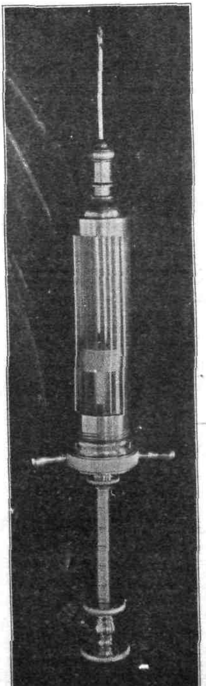

PLATE 15. Virus syringe.

Director of the said Experiment Station may deem advisable for the protection of the swine interests of the State.

From the dosage for serum and virus given on page 212 of this bulletin, the cost of serum and virus necessary to vaccinate any herd can be readily calculated. In addition to this, the owner should employ a competent veterinarian who has been properly instructed in this work and who has received the approval and endorsement of the veterinarian in charge of the Hog Cholera Serum Laboratory of the Kentucky Agricultural Experiment Station.

Three Methods of Inoculating Hogs to Prevent Hog Cholera.

There are three methods used in inoculating hogs for the prevention of hog cholera, viz: The serum alone method; the serum-simultaneous method; and the combination method.

THE SERUM-ALONE METHOD. As the name suggests, this method consists in the use of serum alone on healthy hogs which have been exposed to the disease. It is also advantageously used in herds on adjoining farms or on fields adjacent to places where cholera exists. If the infection is not present, or occurs subsequent to the use of serum alone, the immunity is only temporary or passive in nature, lasting about two months. If during this time the infection is introduced, a longer immunity is gained which lasts six months or more. The serum-alone method of inoculation is often employed when making a show circuit, exhibiting at fairs, shows, etc., to protect the hogs during the period of travel and to avoid a fatal exposure in infected cars or stock yards en route. Some animals in infected herds, though apparently healthy, cannot be saved by this method for the reason that they harbor the disease well advanced in the incubation stage. Body temperatures are taken to detect those infected at the time of inoculation. In this way unhealthy animals may usually be eliminated.

THE SERUM-SIMULTANEOUS METHOD. This method requires the same dose of serum as in the serum-alone method, and in addition, a small amount of virus (cholera blood) is injected into the opposite thigh or opposite side of the neck

PLATE 16. Method of inoculating a pregnant sow.

of the pig. This method is employed when the disease or infection is not present. In order to produce a permanent immunity, it is necessary to artificially inoculate the animal by introducing cholera blood simultaneously with the administration of the serum. This method is also usually employed in infected herds on all hogs not showing visible symptoms of the disease and not registering a temperature above 103 degrees Fahrenheit in the winter time or 103.5 degrees Fahrenheit in the summer time. There are, however, some dangers in employing this method, but if the potency of the serum has been properly tested, as well as the virulency of the virus, and if consideration is given to the condition of the animals to be treated and their susceptibility to the disease, there is practically no danger. It is a well known fact that some hogs are much more susceptible than others to vaccination. This results occasionally in severe transitory effects which last for a few days, but the hog should completely recover. Occasionally a hog so treated may die of cholera and serve as a means of scattering the infection to adjoining lots. If cholera should develop in one animal so treated, it should be isolated and cared for as a true case of hog cholera. The additional expense of the serum-simultaneous method over the serum-alone method is so small that it need not be considered.

THE COMBINATION METHOD. The combination method consists in first using serum alone, followed by the injection of serum and virus in ten or twelve days. This method has the advantage of preparing the animal for the serum-simultaneous treatment, and practically removes all danger of loss following the serum-simultaneous treatment. It should be used especially in valuable herds where the loss of one or two animals would more than pay the entire cost of the vaccination.

How to Determine the Method to Use in Inoculating a Herd*

The proper method to employ in inoculating a herd is, at times, no easy matter to determine. The following mode of procedure will aid the veterinarian and farmer in reaching a

*Circular 14, Experiment Station, E. S Good and R. Graham.

decision. First, a complete history of the herd should be obtained. This history should consist in determining first of all if the herd is diseased or if any of the animals on the place have died and from what cause; the prevalence of hog cholera on adjoining farms or in the immediate vicinity, and the time which has elapsed since the last outbreak of hog cholera occurred on the premises. The history of all newly purchased hogs should also be obtained, if possible. All this information must be fully recorded in the "remarks column" of the record blank furnished by the Experiment Station with every shipment of serum, and returned to the Station. Before a method of inoculation is decided upon it should be ascertained beyond a doubt whether or not the sick animals in the herd are suffering from cholera. In order to do this, the temperature of a sick hog should be taken, after which it should be killed and a post-mortem examination made. If sufficient lesions are not found for diagnostic purposes in the first post-mortem, other sick animals should be killed and subjected to post-mortem examination so that the operator may determine whether the disease is or is not hog cholera. No one should attempt to inoculate hogs until he is qualified to definitely diagnose hog cholera from the symptoms and the post-mortem lesions. Animals that have died are not good subjects for post-mortems as there is danger of the operator contracting blood poisoning through abrasions on the skin of the hands, and, moreover, the natural color of the organs is soon altered after death.

It may or may not be profitable to inoculate hogs in a herd affected with cholera. The serum is a preventive and not a cure, and if all or the greater number of hogs in the herd show visible symptoms of the disease, it is useless to inoculate. However, if the outbreak of the disease has only recently started, a goodly number of the hogs showing visible symptoms of the disease may be saved. In such a herd the serum-alone method should be used and all of the inoculated animals allowed to run on the infected ground. By this method, those hogs that have not already

picked up some of the infection in the natural way, are liable to do so later. This will result in more or less permanent immunity. In other words, the result will practically be the same as if healthy hogs had received the serum-simultaneous inoculation. The temperature of each animal should be taken and recorded. Some animals may appear to be in a perfectly healthy condition, and yet may be incubating the disease. Such animals will generally show temperatures considerably above normal, in some instances as high as 108 degrees Fahrenheit. Animals showing a temperature of 105 degrees or lower may be saved sometimes by the use of serum-alone or in infected herds, there may be even some chance of saving those showing higher temperatures, provided there are no visible symptoms of the disease. It is best to double the dose of serum on pigs showing temperatures but exhibiting no visible symptoms of cholera. In young hogs a temperature of over 103.5 degrees Fahrenheit, or over 103 degrees Fahrenheit in mature hogs, indicates fever, especially if the history of the herd indicates infection with cholera. If an apparently healthy herd is located near an infected herd of hogs, the simultaneous method should be used. No one but an expert, however, should attempt this method of vaccination. Great care must be exercised by the operator in determining that the disease is not already in the herd in the incubation stage. If it is present, no virus should be used, for if employed, it would simply add to the infection already present and result in the loss of animals. The simultaneous treatment can be given to animals in such a herd showing no clinical symptoms of the disease and not registering a temperature over 103 degrees Fahrenheit for mature animals, and 103.5 degrees Fahrenheit for pigs and shoats. Individuals having temperatures higher than this should be given serum-alone. If the weather is warm, the work should be done early in the forenoon or late in the afternoon.

A complete history of the herd to be treated, as well as of neighboring herds, must be filed with the Experiment Station before virus will be sent to the operator.

The serum-alone method should be employed on all recently infected farms or on farms that have had more or less permanent infection for years. All young pigs should be given serum alone before they are ten days old, and a second injection of serum alone, at or about weaning time.

Sows that are suckling pigs should never be given the serum-simultaneous treatment, but both sow and pigs should be given serum alone. After the pigs are weaned, the sows and pigs may be given the simultaneous treatment provided they all look healthy and show normal temperatures.

The serum-alone method should be employed on animals that are about to be shipped on a show circuit. If the circuit extends over a few weeks, it might be well to re-inoculate such a herd four or five weeks after the first inoculation.

Pigs from dams that have been immunized by the serum-simultaneous method before being bred, may be given serum and virus when they are from ten days to three weeks old. Such pigs derive considerable immunity from their dams until they reach this age, and hence stand the simultaneous treatment well. To secure permanent immunity, they should again be inoculated by the serum-simultaneous method when they are weaned. It should be borne in mind, however, that pigs from immune dams and immune sires are not permanently immune. The method mentioned above is the one employed in immunizing the Experiment Station pigs and has been successful so far. The premises on which these pigs run must be considered permanently infected, inasmuch as the building for housing virus pigs for the production of cholera blood, used in hyperimmunization, is located on the same grounds.

It is unwise in extremely warm weather to give a healthy herd of hogs the simultaneous treatment in a non-infected territory, simply for the reason that one or two pigs may become infected with the disease and thus act as a source of infection to neighboring farms.

PLATE 17. *Inoculating small pig in hind flank.*

Method Employed in Keeping the Experiment Station Herd Constantly Immune.*

The breeding herd at the Experiment Station has been kept immunized against hog cholera by the following

*Circular 14, Experiment Station. E. S. Good and R. Graham.

method: All brood sows are immunized by the simultaneous method before they are bred. So far one immunization by this method has been found sufficient to protect the life of the sow from cholera, and some of our sows were vaccinated three years ago. The pigs farrowed from these sows are given the simultaneous treatment before they are three weeks old. They are again vaccinated by the simultaneous method within a week or two after they are weaned. The pigs are never ringed or castrated at the time they are vaccinated.

Pigs from dams that have been immunized by the simultaneous method have considerable immunity against hog cholera until they are three weeks of age. Pigs stand the simultaneous treatment well at this time. After three weeks old, pigs from immune dams may become infected with hog cholera, hence vaccinating such pigs by the simultaneous method before they are three weeks old protects them from the disease until weaning time, and if given the simultaneous treatment after they are weaned they are usually permanently immunized, at least this has been the experience with the Experiment Station herd which has been more or less exposed to infection most of the time.

The combination method of vaccination against hog cholera consists in using the serum-alone method, followed in eight or ten days by the serum-simultaneous method. This method is recommended in vaccinating valuable pure bred herds, especially if highly fitted for show or sale purposes. There is usually a loss of from one to two per cent. of the hogs vaccinated by the simultaneous treatment, whereas no loss should be sustained by the combined method.

Rules to be Observed in Ordering Serum from the Experiment Station.

The following rules for the distribution of serum from the Kentucky Agricultural Experiment Station have been adopted generally:

1. All serum is shipped C. O. D.

2. Serum cannot be returned. This ruling has been made necessary by experience.

3. Do not try to economize in the dosage recommended. A trifle under the prescribed dose may be the cause of losing an animal. An underdose means poor results and is not only worthless but a dangerous procedure if the simultaneous method is employed, since it may result in the death of the hog. Poor inoculation is worse than none at all.

4. Hogs of all sizes and ages are subjects for serum treatment by any of the methods mentioned.

5. Serum is put up in bottles containing 250 cubic centimeters, 500 cubic centimeters and 1000 cubic centimeters, and is packed securely in ice.

Items to be Remembered in Using Serum and Virus.

1. The special hog cholera syringes endorsed by the Bureau of Animal Industry should be used in vaccinating hogs.

2. All syringes and receptacles used for serum and virus while the work of vaccination is being done should be previously sterilized by boiling in water for at least five minutes.

3. *Never use serum and virus in the same syringe in administering the serum-simultaneous method.*

4. Anti-hog cholera serum is primarily a *preventive*, not a cure. When used in large quantities for its slight curative properties, it must be employed at the request of the owner of the animals and with the full understanding of its limited curative powers. We do not recommend its use except in rare instances for curative purposes.

5. The incubation period of hog cholera is from five to twenty days. This means that a pig, though apparently sound, may be quite advanced in the disease. This condition often leads to irregular results in treatment. Do not expect uniform results after the disease has actually appeared in the herd.

6. Do not castrate, ring or mark animals with the knife at the time of inoculation. Pregnant sows frequently abort after being treated with the serum-simultaneous method. It is not advisable to vaccinate them with the serum-simultan-

eous method later than the eightieth (80) day in pregnancy, unless the life of the sow is threatened. Serum alone may be administered safely at any time.

7. In inoculating hogs four men should be on hand to catch and hold them. The securing of hogs should be done quietly, with system and dispatch. If well assisted, one man can inoculate from two to three hundred hogs in one day.

8. Whenever advisable, the owner should consent to allow the operator to kill and hold post-mortem examinations on such animals as he considers necessary to aid in diagnosing the disease.

9. The owner should provide a clean, dust-free place in which to administer the serum. It should be thoroughly cleaned and sprinkled with a good disinfectant solution before the work is started. The hogs must likewise be clean and free from dirt and filth.

Anti-Hog Cholera Serum.

Method of Producing the Dorset-Niles Anti-Hog Cholera Serum.

After years of experimentation, Drs. Dorset and Niles of the United States Bureau of Animal Industry, produced an anti-hog cholera serum that will successfully prevent and control outbreaks of hog cholera.

Cultures of the virus of hog cholera (not including the Bacillus suipestifer) cannot be produced in the laboratory, but are always present in the blood of cholera hogs. The cholera blood or virus, as it is designated, is drawn under aseptic precautions from a pig sick with cholera. In the production of virus, susceptible shoats are inoculated intramuscularly on the inside of the thigh with five cubic centimeters of virus. Within eight to fourteen days, provided the pig is susceptible and the virus virulent, acute cholera will develop. Shoats weighing from thirty to ninety pounds are most desirable for this purpose.

The blood so drawn is defibrinated and used immediately or it is chilled and used the following day for hyperimmunizing purposes. The carcass is examined after the

blood is drawn in order to ascertain such lesions of hog cholera as may be present.

The virus obtained in this way is used to hyperimmunize an immune hog by one of the four methods mentioned before. A hog may gain immunity to hog cholera by passing through an outbreak of the disease or by being artificially immunized with serum alone and natural infection present or by serum and virus. The administration of large

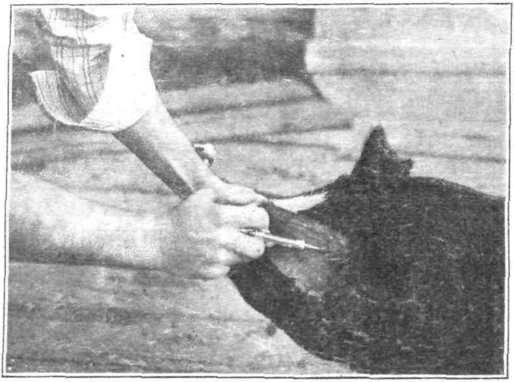

PLATE 18. Applying intradermal tuberculin test to serum hog.

amounts of virus to an immune hog results in a hyperimmune hog. The blood of a hyperimmune hog protects susceptible pigs against hog cholera. The process is known, therefore, as hyperimmunizing.

There are four ways or methods of transforming an immune hog into a hyperimmune hog.

1. The quick subcutaneous method.
2. The slow subcutaneous method.
3. The intraperitoneal method.
4. The intravenous method.

Bleeding of Hyperimmunes.

Anti-hog cholera serum is the defibrinated blood of hyperimmune hogs, to which the proper amount of antiseptic has been added in order to preserve it. In a bacteriological sense it is a concentrated solution of antibodies which antagonize and destroy the virus of hog cholera.

Ten days after hyperimmunization the first tail bleeding is made. This is repeated for two successive times seven days apart. At the fourth drawing seven days later the hog is killed by bleeding from the carotid. In cases where the animal has been a good serum producer and the tail is long enough, the animal may be re-hyperimmunized. In such cases the fourth bleeding is taken from the tail instead of the carotid. It is convenient to re-hyperimmunize immediately after the fourth tail drawing and before taking the animal from the crate. We have found that the introduction of the virus aids in equalizing blood pressure. Our experience indicates this to be a good practice. In ten days the fifth tail drawing is taken and at intervals of one week the sixth and seventh drawings are made. One week later when the eighth drawing is taken from the carotid artery the life of the animal ends. The amount of blood taken at a drawing varies. Some hogs will stand the loss of blood better than others. About five cubic centimeters per pound body weight are extracted at each tail drawing, though in some cases as high as ten cubic centimeters may be drawn.

The blood is drawn into sterile covered milk bottles and afterward defibrinated. To the fibrin free blood or serum, carbolic acid is added to the extent of one-half of one per cent. The serum from each hog is kept in a separate bottle until the hog is killed. Each drawing is labeled on the bottle with date. This is done to avoid mixing any serum from hogs that upon post-mortem examination show lesions of any disease, such as tuberculosis, etc. The serum is stored in a refrigerator from the time it is drawn until it is sent to the field for use.

Determination of the Potency of Serum.

The potency of all serum is tested before it is sent out from the laboratory. After the entire bleeding of several hyperimmunes is obtained, the serum is mixed in a large sterile container. The Kentucky Agricultural Experiment Station endeavors to produce a uniform serum. In order that it may come up to requirements, the potency of all serum thus obtained is determined in the following manner: Eight shoats weighing 50 to 100 pounds each are inoculated; two receive 10 cubic centimeters for each 50 pounds of live weight, two 15 cubic centimeters, two 20 cubic centimeters. At the same time in the opposite thigh two cubic centimeters of virulent blood are given. From five to twenty shoats are inoculated with virulent blood of the same origin without the preventive serum to check the virulency of the virus. If the latter, or "controls" as they are often called, succumb to the disease while those which have been inoculated with the preventive serum live, the Department is justified in considering the serum potent as a preventive against the disease, hog cholera. It should never be used on hogs showing visible symptoms of hog cholera for it is then too late. It should be confined to hogs that have recently been exposed but show no symptoms of the disease.

Common Parasites of Swine.

Parasites of swine are divided into internal and external with respect to their location on the host. The external parasites of hogs include the hog louse and the hog mite which causes mange. The internal parasites consist of those affecting the muscles, and round worms of the intestinal canal.

LICE (*Haematopinus suis*). The hog louse is a common parasite of swine which hog raisers must guard against. If properly handled it is not a serious problem, yet when it gains a hold on a young litter of pigs it may result in permanently stunting them. If lice are not eliminated they multiply rapidly. They are irritating and cause a general

unthrifty condition of pigs, spreading from one animal to another by contact. Frequently, sucking pigs but a few days old are heavily infested from the mother before the owner realizes it. They may develop anywhere or at any season of the year, but are more abundant in hog houses where animals congregate in large numbers. The body heat is sufficient to develop the egg or mite even during the winter months. The eggs are of a yellowish color and attach themselves to the hair about the shoulders, forearm, neck or lower part of the ham.

TREATMENT. Dipping hogs in a coal tar disinfectant will kill hog lice. It cannot, however, be depended on to destroy the egg or nits. Dipping should be repeated in ten or twelve days in order to destroy any lice which develop subsequent to first dipping. The houses at the same time should be thoroughly cleaned of all litter and loose bedding and thoroughly disinfected and whitewashed. It is well to add 2½ pounds of dissolved pure carbolic acid crystals to each fifty gallons of whitewash. Scatter air-slaked lime about the floor of the hog house. Crude oil is very efficient for killing lice and if thoroughly applied will kill the eggs. If crude oil is used it can be hand sprinkled on the hogs when they are confined in a small place. A satisfactory method of applying crude oil in the summer is by pouring the oil in a sanitary hog wallow. The oil remains on the water and results in a thorough application to the hogs. Kerosene emulsion is frequently used to kill lice but it may prove too irritating. Tobacco dip is efficient in killing hog lice and can be used advantageously in a dipping tank. Bedding the hog house with tobacco stems seems to control and prevent lice in hogs and is recommended by many prominent hog raisers.

Mange.

Mange or scabies of the pig is not frequently met with in Kentucky, but the fact that it does occur occasionally warrants a brief description of it in this bulletin.

It is due to a variety of the ordinary mange mite (Sarcoptes scabiei, var. squamiformis) and the results produced

occur as a sequel to the parasite burrowing beneath the skin. It is found almost invariably only in large piggeries and then usually in combination with some other condition, as cholera, rickets, pyobacillosis, insufficient nutrition, poor sanitary conditions, etc.

SYMPTOMS. Violent itching, especially on the head, about the ears and eyes, on the back, sides of the body and between the thighs. Dry scales of the epidermis collect on the surface, the bristles fall out and the skin becomes rough and wrinkled. As the disease progresses the skin becomes greatly thickened.

In general the treatment recommended for lice may be successfully used, especially in the early stages of the condition. Old chronic cases of mange are very difficult to treat owing to the inability of the disinfectants to penetrate the skin sufficiently to destroy the parasites which have burrowed beneath it.

Internal Parasites.

Internal parasites in pigs are not spontaneous. They usually develop from eggs laid by adult worms in the intestinal tract of other hogs. Eggs or cysts are passed by mature worms in the feces of the older hogs and are picked up from the feeding floor or about the hog lot by the young pigs whose digestive functions develop the eggs into mature parasites in the intestines. The result of picking up large numbers of eggs soon manifests itself in the pigs, and the drain on its system in furnishing food and nourishment for only a few worms is sufficient ofttimes to derange its digestive system and cause unthriftiness and death. The secret of thrifty pigs and pigs free from worms lies in cleanly quarters. Prevent them from becoming infected. The individual hog house located in a good blue grass pasture where hogs have not been fed for one year will do a great deal to prevent worms in pigs. A rotation or change of hog lots from year to year is very effective as it is almost impossible to expose pigs and keep them free from worms. At weaning time the pigs should not be allowed to run with

older hogs nor should they be fed in the same place. Keep them separate.

Parasites of the Digestive Tract.

The pig is an excellent host for a large number of internal parasites, due mainly to the diversity of the food eaten and to the natural tendency of the hog to eat any and all kinds of foodstuffs within reach. The so-called "round worms" are practically the only ones met with, and up to this date there is no case recorded of the infestation of swine with tape worms (flat).

SYMPTOMS. A large percentage of all hogs are infested with worms, but usually not in such numbers as to materially interfere with the normal development of the animal. It is, of course, to be borne in mind that they may at any time increase sufficiently to produce an unthrifty condition easily recognized by hog raisers. The only absolutely reliable symptom is to see the animal pass the parasite but the prominent clinical manifestations may be summarized as follows: Inability to take on weight even when the appetite is normal; dull, lusterless condition of the hair coat; paleness of the mucous membranes; alternating diarrhea and constipation; frequent snapping at the sides. Occasionally nervous symptoms will be present, manifested by convulsions which appear suddenly and last but a short time.

The common intestinal parasites in order of their importance are as follows:

1. The Echinorhynchus gigas (see Plate 19) is a thick, cylindrical, white worm, thickest at the head and gradually tapering toward the tail, which is slightly pointed. The body is annular upon its surface, i. e., apparently made up of a series of rings, and it possesses no digestive tract. The development of the worm requires an intermediate host which in a large measure limits its spread. The eggs laid by the adult worm are passed in the feces of the pig and spread over the ground where they are taken up by the white worm or larva of the ordinary June bug and hatch into the larval stage. If this worm is eaten by the pig the

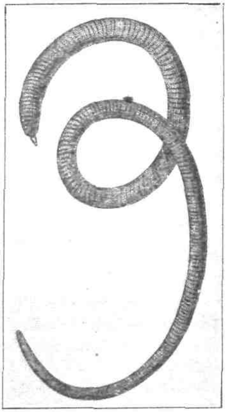

PLATE 19. Echinorhynchus gigas (after Neumann).

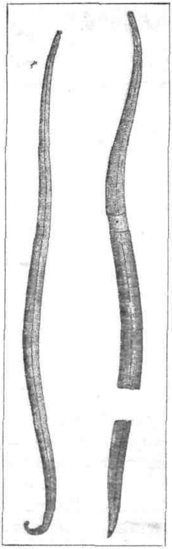

PLATE 20. Ascaris suis (after Neumann).

membrane surrounding the larva is digested, setting free this larva, which now attaches itself to the mucous membrane of the intestines by means of small hooks surrounding the head and there undergoes its future development. Even in the adult stage, at which time the worm often attains the length of twelve inches, it is found adhering to the wall of the intestine.

LESIONS PRODUCED. At the points of attachment, greyish nodules are produced which often contain pus and are con-

tinually in a state of inflammation. Occasionally the worm burrows entirely through the intestinal wall, producing peritonitis and rapid death of the animal. It has been stated that this worm only affects swine which have been fed in the open air. The treatment will be taken up in a separate chapter.

2. ASCARIS SUIS. Unlike the worm just described, these important parasites undergo their development from ova or embryos which are ingested in contaminated feed soiled by the feces of already infected animals. Thus the cycle of transmission is directly from animal to animal, and this fact may largely account for their widespread distribution.

Their characteristics are as follows: White or yellowish white in color; smooth bodies which taper at both ends, eight to twelve inches in length; when examined closely the digestive tract and reproductive organs may be clearly seen through the semi-transparent surface. The worm has a mechanism whereby attachment to the intestinal wall is possible but we have never observed the worm so attached, they invariably being found free in the intestinal contents.

A great number of autopsies held in the laboratory and on farms seem to indicate that this is the common worm found in the hogs of Kentucky.

Approximately 70 per cent. of all pigs upon which complete post-mortems have been held show the presence of worms, and practically three-fourths of these cases are due to the Ascaris suis.

3. TRICHOCEPHALUS CRENATUS (*Whipworm.*) These are rather common but unimportant worms, found usually in the large intestines and most often in the caecum. They are shaped much like a whip the lash of which forms the head end of the body. They vary in length from one and one-half to three inches; are greyish brown in color and occur free in the intestinal contents or in the secretion covering the mucous membrane. Like the worm previously described, they develop from the ova or eggs, which are

commonly taken into the body through the medium of contaminated drinking water.

Measles of the Pig.

Measles is a condition due to the presence in and between the muscles of the pig of a cyst, within which is found the larval form of an adult tape worm of man. It is most likely one of the oldest diseases recorded in history and is said to have been the chief reason for the edict issued by Moses compelling his followers to eliminate pork from their diet.

The condition is rarely if ever determined during the life of the animal and the cysts are only found during the autopsy. The term measles is sometimes erroneously applied to a slight inflammation of the skin over the abdomen which is caused by digestive disturbances.

TREATMENT. To remove internal parasites from hogs, either of the following prescriptions is recommended:

Santonin	2½ grains.
Areca Nut	1 drachm.
Calomel	2 grains.
Sodium Bicarbonate	1 drachm.

The above ingredients should be mixed and given to a one hundred pound hog in the feed.

Oil of Turpentine	4 drachms.
Raw Linseed Oil	6 ounces.

These prescriptions may be increased, depending upon the number of hogs to be treated, by allowing the quantities given in the prescription for each hundred pound hog. Before administering either of the above prescriptions, the animals to be treated should be starved twelve hours. The treatment may be repeated in three or four days, subsequent to dieting.

General Conditioners.

It has long been a current opinion among live stock men that a general conditioning powder is essential for the welfare of farm animals and that only when such substances are administered regularly are animals kept in good condition. Some men go so far as to claim that the feeding of a

certain compound actually increases the food value and fat-producing qualities of feeds. It is perhaps needless to say that such statements will not stand the light of scientific investigation and such opinions are always reached by the association of several related facts, viz: The herd is producing regularly and profitably upon the present system of feeding; in this herd a certain stock food is used according to given directions. Therefore this preparation is an excellent

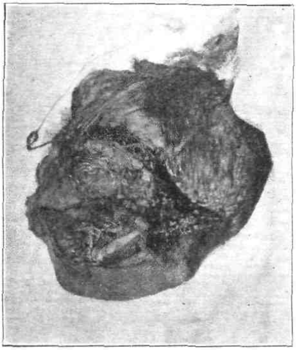

PLATE 21. Verminous bronchitis of the pig. The worms (*Strongylus paradoxus*) are formed in the small air passages of the lungs. The condition is quite common in this section, but is usually not recognized until the animal is slaughtered.

thing for animals. We have always found that these results are in large part due to the husbandman's faithful attention to the secondary directions given with the food in question, i. e., a thorough disinfection of the premises, a practical plan of balancing the ration, proper routine of watering and feeding, etc.

These advertised remedies include in part the following constituents: Copperas, copper sulphate (blue vitriol), char-

coal, salt, magnesium sulphate, fenugreek, sulphur, cayenne pepper, gentian, arsenic, sodium bicarbonate, sodium hyposulphite, iron, etc. The following constitutes a tonic mixture equally efficient and about one-fifth the cost of the advertised remedies. This mixture, however, must not be considered as a specific preventive for hog cholera or for any other disease of hogs, or as a corrector of unfavorable surroundings generally but it is recommended with limitations for swine:

Common Salt	15 lbs.
Wood Charcoal	5 lbs.
Wood Ashes	5 lbs.
Powdered Copperas	1 lb.
Sodium Sulphate	1 lb,
Antimony Sulphide	1 lb.
Sulphur	1 lb.
Sodium Hyposulphite	1 lb.
Lime	1 lb.

The ingredients are to be pulverized and thoroughly mixed and to be given in doses of one ounce to every ten pounds of grain fed, or to be placed where the hogs will have access to it at any time. Hogs require a certain amount of mineral matter for their development and growth.

A Review of the Work Accomplished by the Kentucky Agricultural Experiment Station With Anti-Hog Cholera Serum.

As a result of the Experiment Station's campaign against hog cholera in the State of Kentucky for the past four years, there have been amassed in the office of the laboratory, records covering over a hundred thousand animals treated with anti-cholera serum in a total of two thousand three hundred and seven herds.

It is next to impossible to state the exact saving in dollars and cents to the swine breeders of Kentucky as a result of this work, but with the figures at hand accompanied by the condition of health at the time of vaccination, it is possible

to make an approximation of this figure. The herds and premises upon which the immune serum has been used have been, in the great majority of cases, either infected at the time or directly exposed to infection. Accepting this as a fact we have 102,087 hogs which would in all likelihood have developed hog cholera in a few weeks or months from the time our attention was called to them had hog cholera serum not been administed.

Our records show that of this number of treated hogs 90.59 per cent. lived and were marketed. On the other hand had they not been protected by the use of the immune serum, it is probable that at least 75 per cent. or a total of approximately 76,565 hogs, would have died in the course of a few weeks as a result of the cholera infection. Figuring these animals as being worth $4.00 per head it is conservatively estimated that this saving of hogs would have amounted to $306,260.00. This seems to us to be a fair estimate of the financial value of hog cholera serum to the swine breeders of the State within this period and does not include the stimulus which the swine industry received in consequence.

The following statement covers the production, distribution and administration of hog cholera serum by the Kentucky Agricultural Experiment Station for the calendar years 1911, 1912, 1913, and for the first six months of 1914, the latter by months.

Results in Hog Cholera Eradication.

In 1910 the General Assembly of Kentucky appropriated the sum of $2,000.00 for the erection of a laboratory at the Kentucky Agricultural Experiment Station for the production and distribution of anti-hog cholera serum wherewith to combat the disease in the State of Kentucky. During the year 1911, 287,814 cubic centimeters of serum were produced. The following is a record of the work accomplished with this serum:

Record of Hogs Vaccinated in Kentucky in 1911.

Number herds treated	140	
Number hogs in herds	6355	
Number hogs sick at time of vaccination	797	
Number hogs with high temperatures (over 103.5)	1046	
Number hogs vaccinated	5730	
Method—Simultaneous	65 herds.	
" —Serum-alone	75 herds.	
Number herds reported	122	
Number hogs reported	4133	
Number hogs reported lived	3645	88.2 per cent.
Number hogs reported dead from all causes	488	11.8 per cent.
Number herds not reported	18	
Number hogs not reported	1597	

In 1912 the General Assembly appropriated $50,000.00 to the Experiment Station, a portion of which was to be used for the enlargement of the hog cholera serum laboratory and for the production of sufficient serum to meet the demands of Kentucky farmers. During that year 1,036,435 cubic centimeters of serum were produced and placed at the disposal of all hog raisers in the State. The following is a report of the work accomplished during the year 1912.

Record of Work for Year 1912.

Number of herds treated	414	
Number hogs in herds	19,656	
Number hogs sick	1,915	
Number hogs with high temperatures	2,395	
Number hogs vaccinated	17,591	
Method—Simultaneous treatment	339 herds.	
" —Serum-alone	75 herds.	
Number herds reported	365	
Number hogs reported	15,076	
Number hogs reported lived	13,754	91.2 per cent.
Number hogs reported died	1,322	8.8 per cent.
Number herds not reported	49	
Number hogs not reported	2,515	

In the year 1913, 4,427,120 cubic centimeters of serum were produced and the following work accomplished:

Record of Hogs Vaccinated in 1913.

Number herds treated	923

Number hogs sick	636	
Number hogs with high temperature	5,766	
Number hogs vaccinated	47,673	
Method—Simultaneous	541 herds.	
" —Serum-alone	382 herds.	
Number herds reported	726	
Number hogs reported	38,117	
Number hogs reported lived	34,366	90.2 per cent.
Number hogs reported dead from all causes	3,751	9.8 per cent.
Number herds not reported	197	
Number hogs not reported	9,556	

Summary of the Work for the Years 1911, 1912 and 1913.

Number herds treated	1,477	
Number hogs in herds	78,500	
Number hogs sick at time of vaccination	3,348	
Number hogs with high temperature (over 103.5 degrees)	9,207	
Number hogs vaccinated	70,994	
Method—Simultaneous treatment	945 herds.	
" —Serum-alone treatment	532 herds.	
Number herds reported	1,213	
Number herds not reported	264	
Number hogs reported	57,326	
Number hogs not reported	13,668	
Number hogs reported lived	51,765	90.3 per cent.
Number hogs reported died	5,561	9.7 per cent.

The following maps indicate the progress of the work by counties for the years 1911, 1912 and 1913, each dot representing a herd of hogs treated:

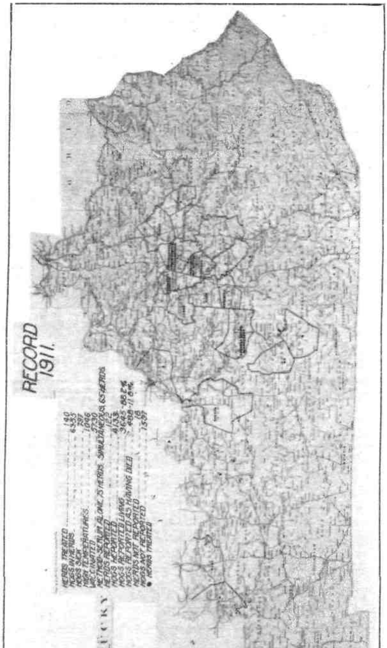

PLATE 22. Map showing hog cholera work in Kentucky for the year 1911.

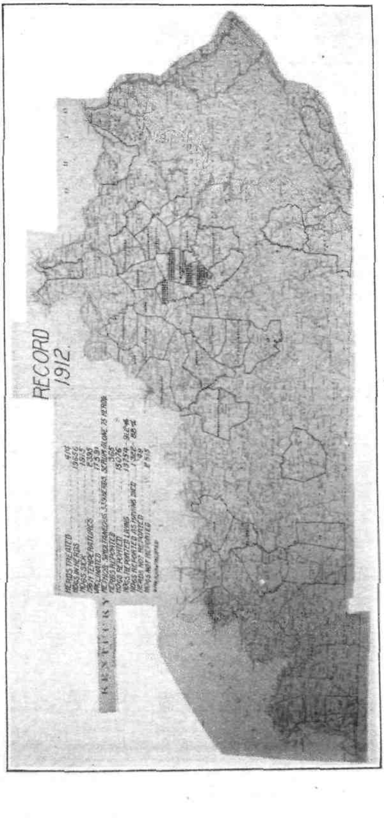

PLATE 23. Map showing hog cholera work in Kentucky for the year 1912.

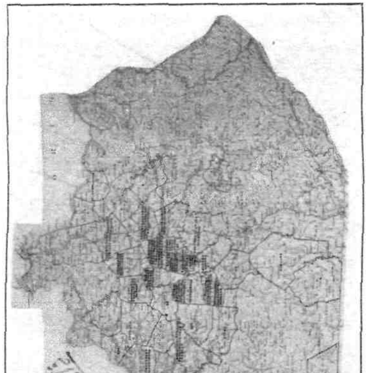

PLATE 24. Map showing hog cholera work in Kentucky for the year 1913.

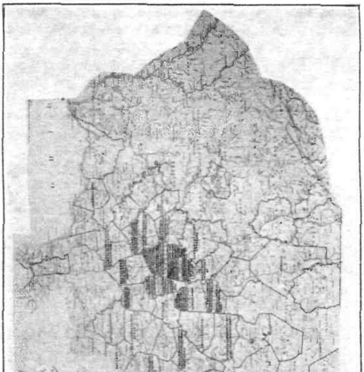

PLATE 25. Map showing hog cholera work in Kentucky for the years 1911, 1912 and 1913, inclusive.

During the first six months of the year 1914, 1,322,221 cubic centimeters of serum were produced at the Serum Laboratory. The following is the monthly record of the work accomplished:

January, 1914.

Number herds treated	139	
Number hogs in herds	5789	
Number hogs sick	370	
Number hogs showing high temperature (over 103.5 degrees)	914	
Number hogs vaccinated	5370	
Number hogs reported	4920	
Number hogs lived	4379	89.01 per cent.
Number hogs died	541	10.99 per cent.
Number herds given simultaneous treatment	54	
Number hogs given simultaneous treatment	2632	
Number hogs lived	2256	89.9 per cent.
Number hogs died	253	10.1 per cent.
Number hogs reported	2509	
Number herds given serum-alone	85	
Number hogs given serum-alone	2738	
Number hogs lived	2123	88.1 per cent.
Number hogs died	288	11.9 per cent.
Number hogs reported	2411	

February, 1914.

Number of herds treated	128	
Number of hogs in herds	4,637	
Number of hogs suspicious (temperature over 103.5 degrees)	953	20.6 per cent.
Number of hogs vaccinated	4,531	
Number of herds reported	116	
Number of hogs reported	4,260	
Number of herds not reported	12	
Number of hogs not reported	271	
Number of suspicious hogs reported dead from all causes	469	49.2 per cent.
Number of suspicious hogs saved by serum	484	50.8 per cent.
Number hogs reported lived	3,791	89.1 per cent.
Number exposed herds treated simultaneously	40	

Number exposed hogs treated simultaneously	1,392	
Number hogs not reported	70	
Number of hogs treated lived	1,214	91.8 per cent.
Number of hogs treated died from all causes	108	8.2 per cent.
Number exposed and sick herds given serum alone	88	
Number exposed and sick hogs given serum alone	3,139	
Number hogs not reported	201	
Number hogs lived	2,577	87.7 per cent.
Number hogs died from all causes	361	12.3 per cent.

March, 1914.—Apparently Healthy Herds.

Number herds treated simultaneously	34	
Number hogs treated simultaneously	968	
Number hogs suspicious (temperature over 103.5 degrees)	202	
Number hogs reported	936	
Number hogs not reported	32	
Number herds reported	32	
Number herds not reported	2	
Number hogs treated lived	906	96.7 per cent.
Number hog treated died from all causes	30	3.3 per cent.

Suspicious and Infected Herds.

Number herds treated serum-alone and simultaneously	25	
Number hogs treated	1,030	
Number hogs suspicious (temperature over 103.5 degrees)	127	
Number hogs reported	960	
Number hogs not reported	70	
Number herds reported	24	
Number herds not reported	1	
Number hogs treated lived	909	94.6 per cent.
Number hogs treated died from all causes	51	5.4 per cent.

Suspicious and Sick Herds.

Number herds given serum-alone	86	
Number hogs given serum-alone	3,072	
Number hogs suspicious (temperature over 103.5 degrees)	718	
Number hogs reported	2,817	
Number hogs not reported	255	

Number herds reported	79	
Number herds not reported	7	
Number hogs treated lived	2,558	90.8 per cent.
Number hogs treated died from all causes	259	9.2 per cent.

April, 1914—Apparently Healthy Hogs.

Number herds treated simultaneously	43	
Number hogs treated simultaneously	1364	
Number hogs suspicious (temperature over 103.5 degrees)	193	
Number hogs reported	1364	
Number hogs not reported	000	
Number herds reported	43	
Number herds not reported	000	
Number hogs treated lived	1249	91.57 per cent.
Number hogs treated died from all causes	115	8.43 per cent.

Suspicious and Possibly Exposed Herds.

Number herds treated, serum-alone and simultaneously	21	
Number hogs treated, serum-alone and simultaneously	1183	
Number hogs suspicious (temperature over 103.5 degrees)	184	
Number hogs reported	1158	
Number hogs not reported	25	
Number herds reported	20	
Number herds not reported	1	
Number hogs treated lived	1101	95.08 per cent.
Number hogs treated died from all causes	57	4.92 per cent.

Suspicious and Sick Herds.

Number herds given serum-alone	103	
Number hogs given serum-alone	4229	
Number hogs suspicious (temperature over 103.5 degrees)	872	
Number hogs reported	4127	
Number hogs not reported	102	
Number herds reported	97	
Number herds not reported	6	
Number hogs treated lived	3694	89.5 per cent.
Number hogs treated died from all causes	433	10.5 per cent.

Summary.

Total number of hogs treated	**6776**
Total number of hogs treated reported	**6649**
Total number of hogs suspicious (temperature over 103.5 degrees)	**1249**

Total number of hogs lived	6044	90.9 per cent.
Total number of hogs died	605	9.1 per cent.

May, 1914—Apparently Healthy Herds.

Number herds treated simultaneously	38	
Number hogs treated simultaneously	1592	
Number hogs suspicious (temperature over 103.5 degrees)	195	
Number hogs reported	1565	
Number hogs not reported	27	
Number herds reported	37	
Number herds not reported	1	
Number hogs treated lived	1496	95.6 per cent.
Number hogs treated died from all causes	69	4.4 per cent.

Suspicious and Possibly Exposed Herds.

Number herds treated serum-alone and simultaneously	19	
Number hogs treated serum-alone and simultaneously	1081	
Number hogs suspicious (temperature over 103.5 degrees)	127	
Number hogs reported	990	
Number hogs not reported	91	
Number herds reported	17	
Number herds not reported	2	
Number hogs treated lived	943	92.25 per cent.
Number hogs treated died from all causes	.47	4.75 per cent.

Suspicious and Sick Herds.

Number herds given serum-alone	94	
Number hogs given serum-alone	3296	
Number hogs suspicious (temperature over 103.5 degrees)	879	
Number hogs reported	3044	
Number hogs not reported	252	
Number herds reported	85	
Number herds not reported	9	
Number hogs treated lived	2739	89.9 per cent.
Number hogs treated died from all causes	305	10.1 per cent.

Summary.

Total number of hogs treated	5969	
Total number of hogs treated reported	5599	
Total number of hogs suspicious (temperature over 103.5 degrees)	1201	
Total number of hogs lived	5178	92.48 per cent.
Total number of hogs died	421	7.52 per cent.

June, 1914—Apparently Healthy Herds.

Number herds treated simultaneously	35	
Number hogs treated simultaneously	1229	
Number hogs suspicious (temperature over 103.5 degrees)	207	
Number hogs reported	1229	
Number hogs not reported	0	
Number herds reported	35	
Number herds not reported	0	
Number hogs treated lived	1181	96.09 per cent.
Number hogs treated died from all causes	48	3.91 per cent.

Suspicious and *Possibly* Exposed Herds.

Number herds treated serum-simultaneously	8	
Number hogs treated serum-simultaneously	317	
Number hogs suspicious (temperature over 103.5 degrees)	32	
Number hogs reported	317	
Number hogs not reported	0	
Number herds reported	8	
Number herds not reported	0	
Number hogs treated lived	313	98.73 per cent.
Number hogs treated died from all causes	4	1.27 per cent.

Suspicious and Sick Herds.

Number herds given serum-alone	57	
Number hogs given serum-alone	1831	
Number hogs suspicious (temperature over 103.5 degrees)	584	
Number hogs reported	1634	
Number hogs not reported	197	
Number herds reported	51	
Number herds not reported	6	
Number hogs treated lived	1467	89.8 per cent.
Number hogs treated died from all causes	167	10.2 per cent.

Summary.

Total number of herds treated	100	
Total number of hogs treated	3377	
Total number of hogs treated reported	3180	
Total number of hogs suspicious	823	
Total number of hogs lived	2961	93.1 per cent.
Total number of hogs died	219	6.9 per cent.

Summary of Results From January 1st, 1914 to July 1st, 1914.

Total number of herds treated	830	
Total number of hogs vaccinated	31,093	
Total number of hogs treated reported	29,321	
Total number of hogs suspicious (temperature over 103.5 degrees)	6,187	
Total number of hogs not reported	1,772	
Total number of hogs treated lived	26,726	91.15 per cent.
Total number of hogs treated died from all causes	2,595	8.85 per cent.

Summary of Results for the Years 1911, 1912, 1913 and to July 1st, 1914.

Total number of herds treated	2,307	
Total number of hogs vaccinated	102,087	
Total number of hogs treated reported	86,647	
Total number of hogs suspicious (temperature over 103.5 degrees)	18,742	
Total number of hogs not reported	15,410	
Total number of hogs treated lived	78,491	90.59 per cent.
Total number of hogs treated died from all causes	8,156	9.41 per cent.

REGULATIONS* OF THE KENTUCKY LIVE STOCK SANITARY BOARD RELATIVE TO HOG CHOLERA.*

"Section 1. No swine shall be shipped, driven, trailed or otherwise brought into the State of Kentucky for other than immediate slaughter without having been inoculated by the serum alone treatment within thirty days before shipment or by the serum simultaneous treatment at least twenty-one days before date of shipment.

Section 2. No swine within the State of Kentucky diseased with what is known as hog cholera or which have been exposed to such disease shall be shipped, driven or otherwise removed over public highways from one farm or lot to another farm or lot or be kept in a field or enclosure adjacent to any public highway or through which a running stream flows except as hereinafter provided.

Section 3. Wherever a case of hog cholera is suspected to exist it shall be the duty of the person owning said animal or any other person to notify the County Live Stock Inspector and the County Live Stock Inspector shall immediately make an examination and if he finds cholera to exist to order a quarantine of such animal or animals and of any exposed animals. The County Live Stock Inspector may order the destruction of any diseased animal and the treatment of any exposed animal by the serum alone treatment; or the County Live Stock Inspector after an examination of the exposed animal or animals may authorize the shipment of such animal or animals as do not show any clinical symptoms of the disease, for immediate slaughter. The movement of such exposed animals to market shall be in wagons, cars or boats that have been thoroughly disinfected by one of the methods enumerated in the general provisions heretofore prescribed and after the said exposed hogs have been disinfected with a 2 per cent. solution of cresol compound or a 3 per cent solution of 95 per cent. pure carbolic acid or a coal tar cresote dip of one part of dip to fifty parts of water.

Section 4. The carcass of any hog that has died within the State of Kentucky from the disease known as hog cholera shall be burned on the premises upon which it died. The hauling of carcasses of animals dying from said disease upon the public highways of this State or the disposal of them into flowing streams is strictly forbidden. This rule does not

*Rules and Regulations of the State Live Stock Sanitary Board, Regulation III, pages 17 to 22.

apply to disposal of carcasses within a city limit. Any wagon or vehicle used for the removal of carcasses of swine dying from the disease of hog cholera is prohibited upon the public highways of the State of Kentucky with the exception of the streets of an incorporated town, unless they have been thoroughly disinfected by one of the methods heretofore prescribed.

Section 5. All swine shipped into the State for exhibition purposes shall be accompanied by a certificate issued by the State Veterinarian, Assistant State Veterinarian or other legally authorized inspector of the State from which the shipment is made or an inspector of the United States Bureau of Animal Industry, showing that such swine are free from the disease of cholera and shall have had the serum simultaneous treatment at least three weeks prior to entry into the State, or serum alone treatment within thirty days prior to shipment.

Section 6. Public stock yards at market centers shall be considered as infected with hog cholera and no movement of swine therefrom shall be made for breeding or stocking purposes except as follows: Swine intended for purposes other than immediate slaughter may be shipped from public stock yards provided, that on inspection within twenty-four (24) hours after arrival by an inspector duly authorized by this Board, they are found to be free from symptoms of cholera and other contagious or infectious diseases, and that they are treated by a competent veterinarian, under supervision of said inspector, in a portion of the stock yards set aside for that purpose, in accordance with one or other of the methods set forth under (a) and (b), (c) and (d) following:

(a) Serum alone method. The swine may be given the serum alone inoculation with hog cholera serum prepared under license from the National Secretary of Agriculture, or approved by the State Live Stock Sanitary Board or the Kentucky Agricultural Experiment Station. After receiving this treatment they shall be disinfected in a 2 per cent. solution of cresol compound U. S. P. and be held in non-infected pens for at least six hours before being loaded for transportation.

(b) Serum simultaneous method. The swine may be given the simultaneous inoculation with hog cholera serum and virus prepared under license from the National Secretary of Agriculture, the State Live Stock Sanitary Board, or the Kentucky Agricultural Experiment Station. After receiving this treatment they shall be held under supervision

for a period of not less than twenty-one days. If at the close of this period they exhibit no symptoms of hog cholera or other contagious disease, they shall be disinfected in a 2 per cent. solution of cresol compound U. S. P. and be held in non-infected pens for at least six hours before being loaded for transportation.

(c) Clean and disinfected cars or other vehicles only shall be used for the movement of swine which have been given the serum alone inoculation or the serum simultaneous inoculation, and such movement must in every case be under certificate issued by an inspector of the Bureau of Animal Industry, or State or County Live Stock Inspector, or other duly authorized official indorsed by an inspector of the Bureau of Animal Industry.

(d) Cars and other vehicles and pens or yards which have contained shipments of diseased or exposed swine shall be cleaned and disinfected as soon as possible after unloading. Cars that have contained shipments of swine destined to market centers shall not be removed until the inspector has ascertained the condition of the live animals and either released the cars or given notice that they shall be cleaned and disinfected. Cleaning and disinfecting shall be done by first removing all litter and manure and then saturating the interior surfaces of the cars and woodwork, flooring and ground of the chutes, alleys and pens with a solution made with 4 ounces of cresol compound U. S. P. to each gallon of water, to which should be added sufficient lime (not to exceed 1½ pounds per gallon) to show where it has been applied.

Section 7. That all serums, virus and other biological products used in the treatment of animal diseases can only be sold or offered for sale or distribution in the State of Kentucky under a specific permit of the Kentucky State Live Stock Sanitary Board. All serums, virus and other biological products manufactured or licensed by the United States Bureau of Animal Industry or manufactured by the Kentucky Agricultural Experiment Station, Lexington, Kentucky, are hereby approved by this board.

Section 8. No person, firm or corporation shall be permitted to bring into the State of Kentucky any virus containing the germs of hog cholera, whether the use of such virus by competent persons is authorized by this Board or not, unless it is used under the general direction of a State or County Live Stock Inspector, graduate veterinarians employed by the Kentucky Agricultural Experiment Station, or a representative of the United States Bureau of Animal Industry.

Section 9. No virus shall be used except under the general direction of State or County Live Stock Inspectors, graduate veterinarians regularly employed by the Kentucky Agricultural Experiment Station, or a representative of the United States Bureau of Animal Industry, and then only upon hogs enclosed in pens separate from the non-inoculated hogs with proper sanitary provisions, and kept confined for at least twenty-one days after the use of said virus. But no hogs shall be given the serum-simultaneous treatment where drainage from pens in which they are confined is directly into any flowing stream, and no person shall be permitted to enter said pens except the immediate attendants of said hogs. Every precaution must be taken to prevent the contamination of flowing streams with hog cholera germs, and to prevent the germs from being carried by human beings, rats, birds or other means from one herd of hogs to another. These sanitary provisions must be under the general direction of the State Live Stock Sanitary Board, State or County Live Stock Inspector, graduate veterinarians regularly employed by the Kentucky Agricultural Experiment Station, or a representative of the United States Bureau of Animal Industry.

Section 10. No restriction is placed on the use of the serum-alone treatment by veterinarians or live stock owners, but this Board advises any farmer or live stock owner to employ a competent veterinarian, or correspond with the authorities of the Kentucky Agricultural Experiment Station, Lexington, Kentucky, for general directions before undertaking the use of the serum."

ERRATUM.

The word suispestifer as this occurs on pages 179, 180, 181 and 182, should be spelled suipestifer.